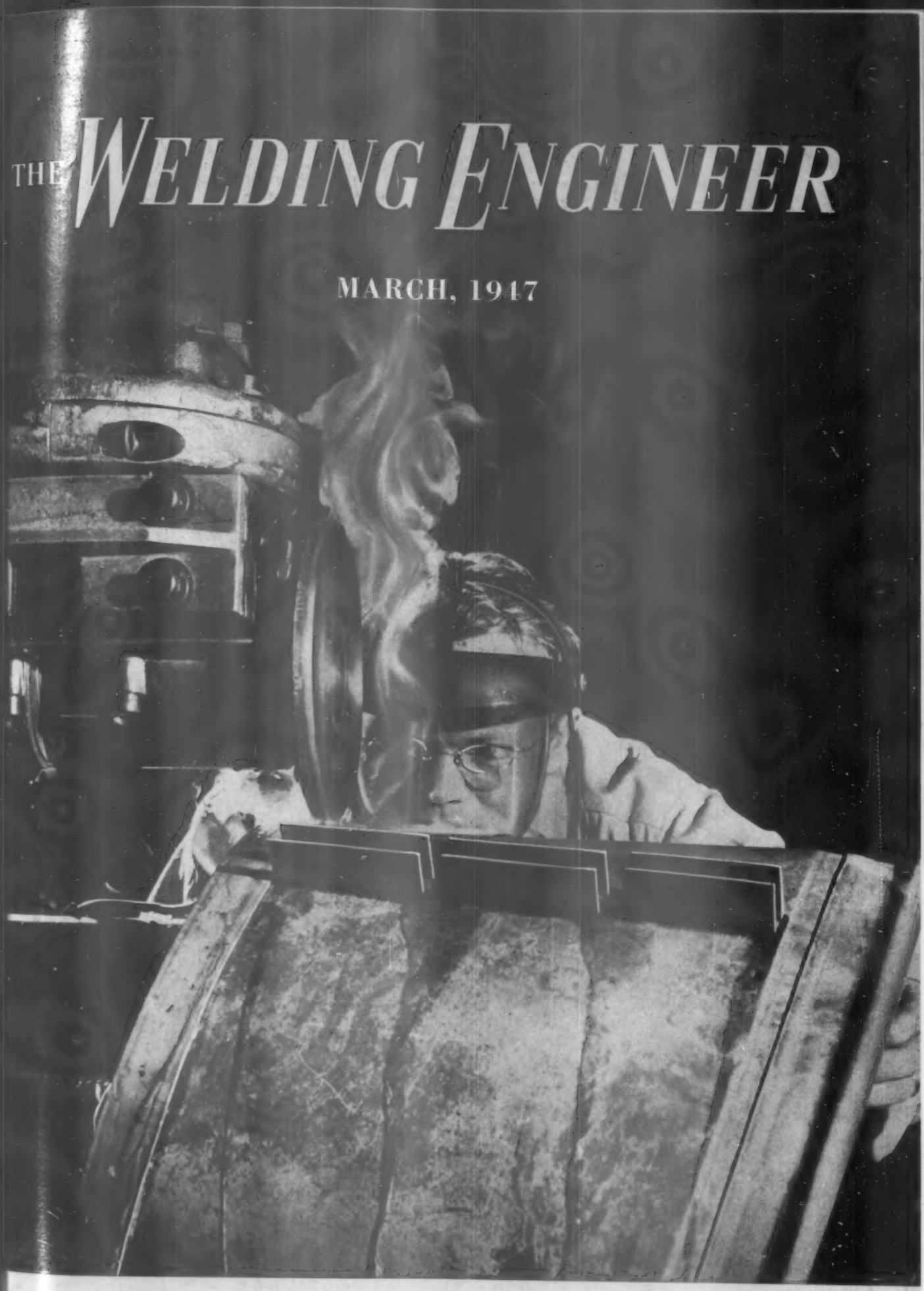
THE WELDING ENGINEER

MARCH, 1947



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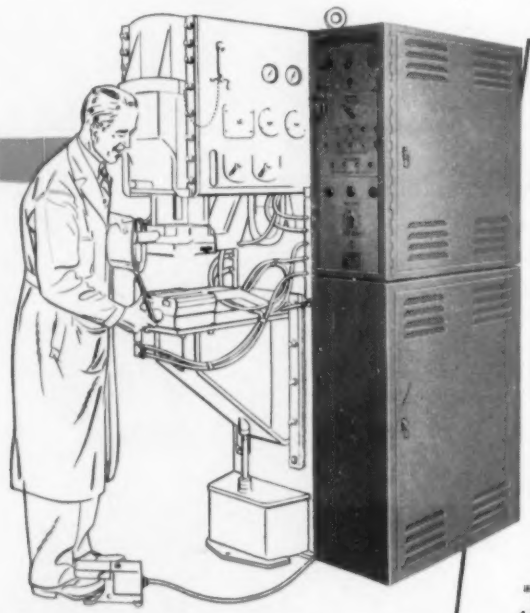

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THE WELDING ENGINEER

THE WELDING ENGINEER, *with which is combined The Acetylene Journal*

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THE WELDING ENGINEER

MARCH, 1947

No Fetters on Progress

AN ANCIENT PHILOSOPHER once said, "There is no knowable limit to change or growth. Perhaps there is nothing impossible but thinking makes it so." Both of these ideas seem to apply well and often where welding is concerned.

An example of how aptly "nothing impossible but thinking makes it so" fits into the picture is recalled by a discussion I had not so long ago with one of the top authorities on the design of dredging equipment. Going over the blueprints, I noted one glaring example of construction that was exactly the same as it had been for the past 40 years. "Why don't you weld that?" I ventured to ask. The answer came, loud and clear, "It can't be done. Welding just won't work." I wondered, and not to myself, WHY. Ten years ago I had designed just such a job for welded construction, and it had worked. I voiced these recollections. "It won't work," he replied, "because we tried to weld such a piece on a dredge in 1921 and it didn't stand up."

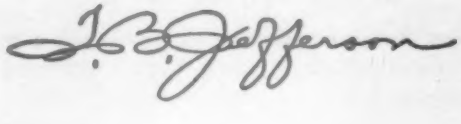
Welding didn't work 26 years ago, so it wouldn't work now! This is an excellent illustration of thinking makes it so. Or, perhaps, of thinking that indicates no thought.

My engineering friend would be the first to admit that in the past 26 years dredging equipment has been improved. He knows in great detail all of the improvements in steel, electrical apparatus, internal-combustion engines and other items that go into the building of a dredge. He will tell you that because of improved design in equipment, dredging machinery has become more reliable, more efficient and will operate at a lower cost. Yet he apparently doesn't even suspect that a parallel line of development may have been followed by welding.

Unfortunately, the "It wouldn't work in 1921" school of thought is all too typical. Persons can see the improvements in their own field but appear to be willfully blind to new developments elsewhere. My friend, for instance, failed to realize that since his 1921 experiment welding has changed from a little used maintenance process to the metal-working industry's major means of joining metals. He completely ignored the many new processes, and techniques that have been invented.

If you will look in the history books—any of them—you will find that whenever civilization has taken a step forward it was because there was some daring soul who didn't know that Aristotle or another classical authority had laid down the dictum that a certain thing couldn't be done. So this poor misguided ignoramus just went ahead and did it.

"There is no limit to change or growth in welding." Let's pass that good word along.



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Welded Locomotive Boilers

★ PRODUCTION

Are Here to Stay

Two pioneer installations of all-welded boilers for locomotives have been in service for nearly a year on the Canadian Pacific Railway. Over twenty others have been completed or are under construction. Methods of fabrication are detailed in this article.

Two locomotives with welded boilers, trail blazers in Canadian railway motive power, have been in operation by the Canadian Pacific Railway between Montreal and Toronto and Winnipeg and Regina since early in 1946. On these and the 22 other welded locomotive boilers ordered for American railroads during the year, most of the welding is done by the submerged-melt process.

(Headpiece) A pioneer installation of an all-welded boiler, this locomotive of the Canadian Pacific Railway is undergoing close scrutiny by the railroad industry of the United States

Improvements Expected

Canadian Pacific mechanical experts expect the new fusion-welded boilers to eliminate or reduce considerably some of the undesirable features of the usual riveted locomotive boilers. The operating performance of the engines is being carefully watched to see if they will succeed in any of the following nine points of possible improvement:

1. Eliminate cracks due to intergranular corrosion and high stress concentration in rivet holes.
2. Increase joint efficiency as compared to riveting.
3. Reduce weight by the elimination of lap joints, inside and outside welts and rivets.
4. Eliminate the possibilities of age-hardening of cold worked plates by final thermal stress-relief heat treatment.
5. Eliminate high stresses around rivet holes.
6. Eliminate stress risers due to abrupt change in section. An example of this is the excess thickness at girth and longitudinal seams of the riveted boiler.
7. With the more uniform contour of the interior and exterior of the welded boiler and the absence of welts and rivet heads, permit ease of application of brackets and facilitate cleaning of the interior.
8. Eliminate damage due to the caulking of rivets.
9. Result in a more economical method of fabrication.

Work carried out by the mechanical engineering department of the C.P.R. resulted in the fitting by the Montreal Locomotive Company of two new "1200" class engines (4-6-2 wheel arrangement) with the new boilers. The latter were built by the American Locomotive Co., Schenectady, N. Y. The first locomotives of this type to operate on Canadian lines, they are now being run in regular service under varying operating conditions.

Decision to try them was prompted by the good service obtained from welding in other instances, including a welded locomotive boiler now in service on the Delaware and Hudson. This locomotive was built in 1936 and has been in continuous service up to the present time without a single leak in any of the welded joints.

General Description

The C.P.R. boilers were built to operate at a working pressure of 250 psi, with a safety factor of five and an allowable joint efficiency of 90%. They differ from the Delaware and Hudson Railroad Company's boiler in that (1) the barrel portion consists of three barrel courses butt welded together and (2) a manhole opening in place of the conventional steam

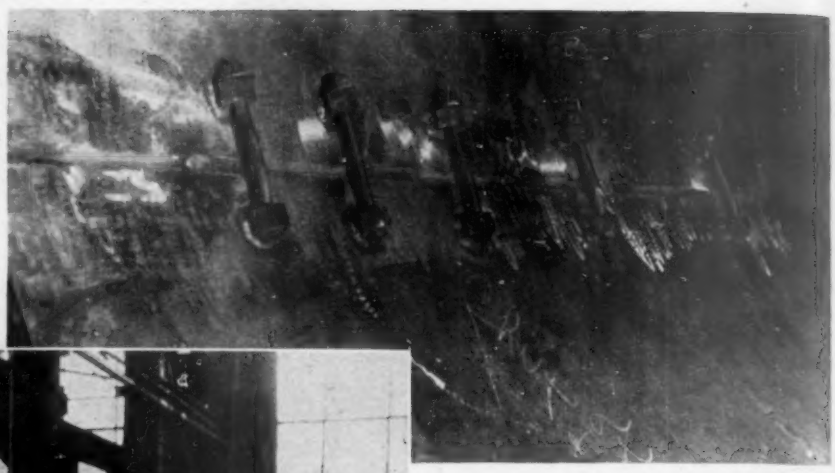


Fig. 1—Nuts were welded to each side of the longitudinal seam, and draw bolts pulled the edges together. The plates were then tack welded on the inside to hold the alignment during the automatic welding of the seam

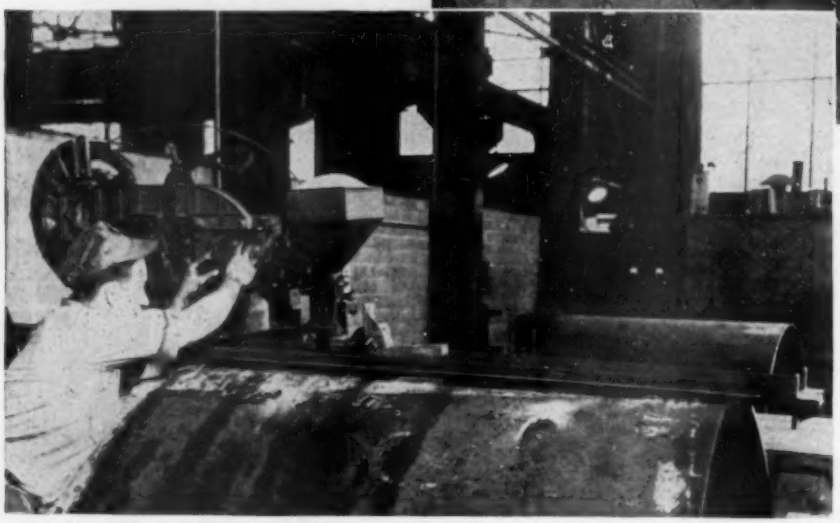


Fig. 2—Welding an outside seam. The longitudinal seams were welded automatically by submerged-melt

dome is provided in the third course to facilitate internal inspection.

The foundation rings are cast steel with a single rivet construction; the caulking edges of the inside and outside firebox sheets are seal welded. The smoke box is fastened to the first course by riveting. This is done to facilitate renewal of the smoke box, which must be replaced three or four times during the life of a boiler.

The wrapper sheet consists of a three-plate construction, which permits using a heavier sheet over the crown. This eliminates the need for a liner, which is generally used to stiffen the crown of one-piece wrapper sheets.

The manhole is flanged from 1-in. plate and has an overall diameter of 34½ in. and an opening of 17-in. diameter. The boiler shell opening at the manhole is reinforced with a 1⅛-in. liner, 25 in. ID by 40 in. OD, which is attached to the manhole flange and boiler shell by fillet welds at the inside and outside edges of the liner.

Pads for top check, washout opening, bracket attachments for dry pipes and other internal and external fittings are fillet welded to the boiler shells immediately prior to stress relieving.

All washout plug bushings and flexible staybolt sleeves are seal welded to the back head, wrapper sheet and throat sheet after stress relieving.

The firebox door opening is formed, in the usual manner, by flanging the outside back head inward and the inside back head outward. The two edges are joined together by a butt weld on one side.

The front tube sheet, of the same design as that used in the Delaware & Hudson all-welded boiler, consists of a circular ring 1¼-in. thick by 4⅜-in. wide. It has a recess at the water side in which the tube sheet is fitted and fillet welded on both sides. The complete tube sheet assembly is then fitted and fillet welded to the first course. The ring is provided with slots at the top and bottom centers. These permit the tube sheet to be renewed without cutting any of the welds except those that directly attach it to the circular ring.

Plates used in the boiler shells were carbon steel to ASTM specification A-201, Grade A, killed, for automatic submerged-melt welding. The inside firebox sheets were carbon-steel plates of firebox quality to the railway company's specification.

Joint Preparation

The girth and longitudinal seams of the barrel courses were made by automatic submerged-melt welding. The edges were prepared on a plate planer prior to rolling and forming. The inside and outside back head, throat sheet, back tube sheet and fire door hole were prepared for manual welding by chipping and grinding the plates. A tolerance of 0.015 in. was permitted in the gap between the plate edges welded automatically and a ⅛-in. gap between joints that were welded manually.

To obtain the tolerance required for automatic welding, it was found necessary to grind the butting faces prior to pulling them together. Large nuts were tack welded to each side of the seams inside the boiler (Fig. 1), and draw bolts were inserted to hold the seams in line and to pull the butting edges together. After each seam had been properly lined up, the plates were tack welded on the inside to maintain a good fit during welding on the outside. Clean-up grinding of the plate edges was also done in order to remove all dirt and scale which might cause weld defects.

Wherever practicable, the longitudinal and girth seams were welded automatically by the sub-

merged-melt process (Fig. 2). After the outside welds were completed, the draw bolts, nuts and tack welds were removed, and the inside of the seam was made ready for welding. Fig. 3 shows the welding of the outside and Fig. 4 the welding of the inside of the girth seam between the first and second courses.

The manhole is fitted into the third course and attached by a butt weld on both sides. This welding is also done automatically (Fig. 5). The wrapper and throat sheets are likewise welded automatically to the third course (Fig. 6). The subassembly of the front tube sheet is one of the few parts fabricated by means of manual arc welding (Fig. 7).

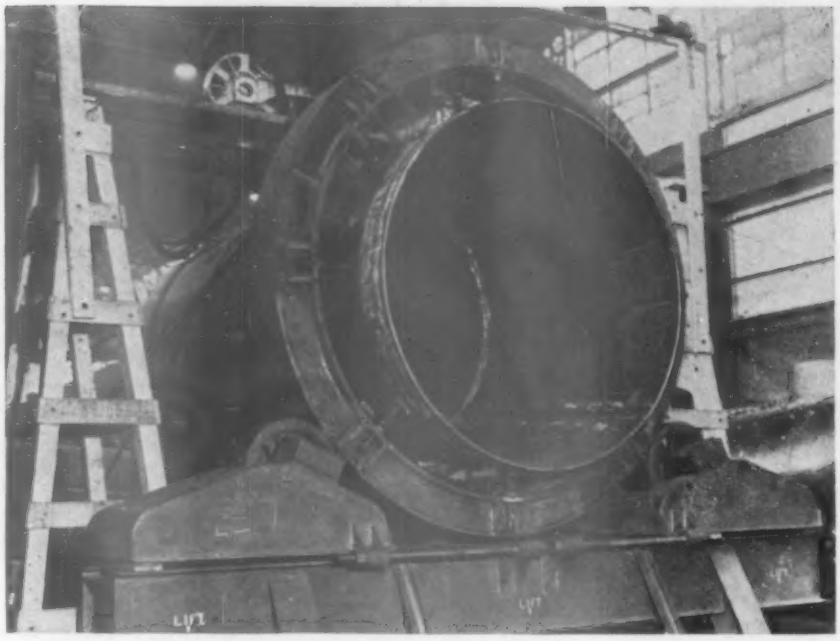


Fig. 3—Automatically welding the outside of the girth seam between the first and second courses. Note positioning rolls to turn the weldment and the large auxiliary ring that compensates for the eccentric course

Test Procedures

All welding was in accordance with the ASME Locomotive Boiler Code. Procedure qualification and operator's qualification tests were made under conditions similar to those used during erection of the boilers in order to determine the suitability of the welding technique employed, welding apparatus, electrodes, plate material and the operator's ability to produce sound welds.

The procedure qualification tests consisted of welding joints similar to those required for erection of the boilers, using the welding and rotating equipment employed during construction. A record of all qualification tests was kept for future reference.

Test plates were attached to the longitudinal seams of each barrel course (Fig. 8) and welded continuously with the seam. Identification marks were attached to each test plate so that it could be identified in relation to the course from which it was taken. Test plates were stress relieved with the boilers and then given the physical test required. The tests applied to the test coupons showed the joint to be superior to the parent metal in all cases.

All fillet welds and a small percentage of the irregular butt welds were made with the manual arc, using AWS E-6011 (all-position) electrodes.

The total lengths of fillet and

Fig. 4 (right)—Welding the inside of the girth seam between first and second courses. Submerged-melt automatic welding is used here, too

Fig. 5 (below)—Welding the manhole to the third course is a job for automatic welding

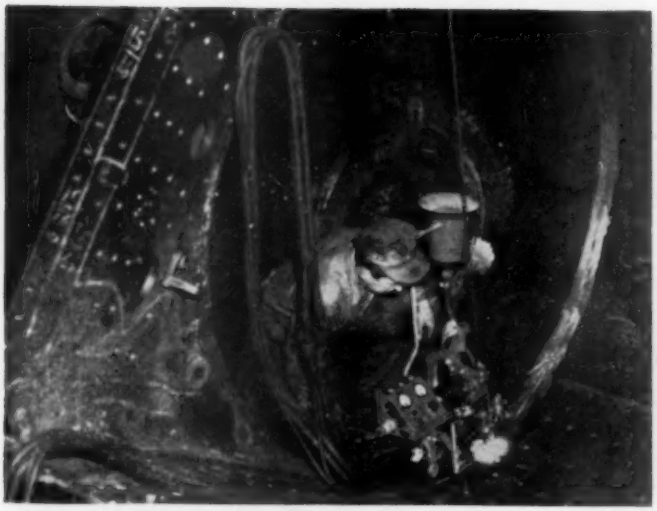


Fig. 6—Welding the third course to the wrapper sheet and throat sheet. Manhole is fitted to the third course

Fig. 7—Fabricating front tube sheet subassembly and mounting flange. This tricky job is best done manually

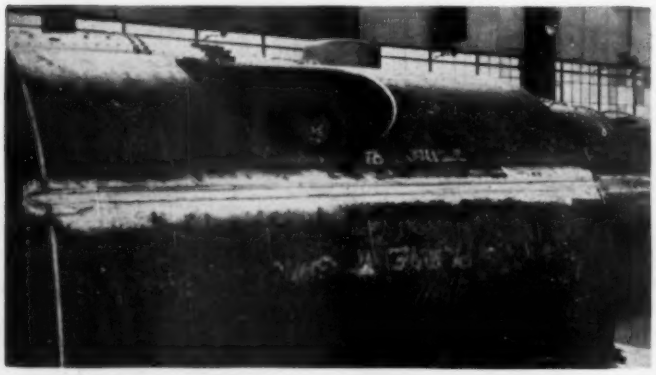


Fig. 8—Welded longitudinal seam showing starting tab (left) and test coupon. The latter is stress relieved with the boiler before it undergoes destructive testing

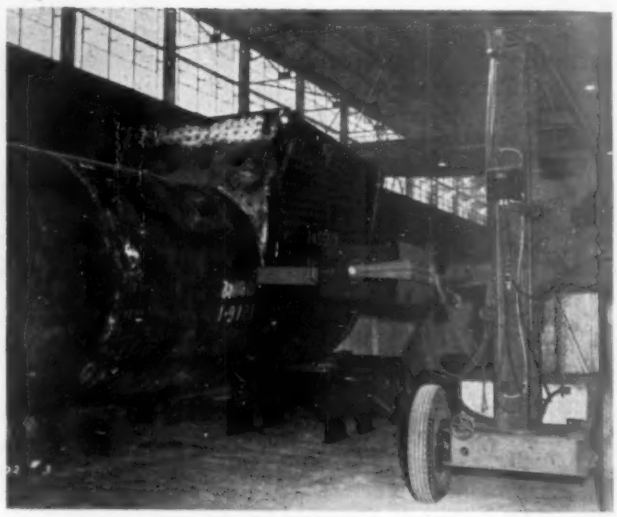


Fig. 9—Boiler seams undergo stringent X-ray inspection. Note the lead arrows pointing to punch marks. Defects can be quickly located by means of these reference marks

butt welds and the various sizes of electrodes required were:

Fillet Welds

¼-in.—658 in. (54 ft, 10 in.)
⅜-in.—713 in. (59 ft, 5 in.)
½-in.—730 in. (62 ft, 6 in.)
⅝-in.—318 in. (26 ft, 6 in.)

Butt Welds

⅜-in.—586 in. (48 ft, 10 in.)
½-in.—206 in. (17 ft, 2 in.)
9/16-in.—113 in. (9 ft, 5 in.)
2 5/32-in.—229 in. (24 ft, 11 in.)
2 7/32-in.—775 in. (64 ft, 7 in.)

X-Raying Boiler Seams

X-raying was carried out in accordance with the ASME locomotive boiler code requirements. A portable unit mounted on a rubber-tired carriage was used (Fig. 9).

For ease in locating possible defects, lead numbers were attached to a cloth strip at 2-in. intervals. The cloth was then attached to the boiler, close enough to the weld so that the lead numbers would show up on a 4½ by 17 in. X-ray negative. The numbers started at the front of each longitudinal seam, and for girth seams started at the front longitudinal seam and ran counterclockwise. Light center punch marks to which lead arrows pointed were also made alongside each seam at 10-in. intervals. The punch marks served as a permanent means of locating defects. When, for example, a defect was found on an X-ray negative, the negative itself was placed on the boiler and positioned exactly by placing the center punch marks on the negative directly over those on the boiler. This procedure eliminated all possibilities of mistakes.

A wagon-bottom, indirect-heating furnace, was used for stress relieving. The temperature was raised 100 F per hour up to a maximum temperature of 1,175 F, at which the furnace was held for 2½ hr. It was then cooled at a rate of 100 F per hour until a furnace temperature of 200 F had been reached, when it was air cooled.

After the stress-relieving heat treatment, the boilers were then hydrostatically tested to 1½ times the maximum allowable working pressure. While under the hydrostatic pressure, all unstayed seams were hammer tested by striking each side of the seams at 6-in. intervals. Finally, the boilers were given the usual steam test.

★ PRODUCTION

Nash Builds All-Welded Bodies

Fig. 1—Applying primer to the floor side sill panels and shock absorber housing. This coating prevents oxidation during welding and later serves to protect against rusting

Through use of spot and arc welding Nash-Kelvinator is producing an automobile of all-welded construction which affords greater safety at no extra operating cost.

BY JOHN H. GIROUX

IN 1937 the Nash Motors Company merged with the Kelvinator Corporation, producer of the Kelvinator refrigerator, to form the Nash-Kelvinator Corporation. Three years later the consolidated corporation decided to restyle its automobile to attract a larger consumer public. This was to be accomplished by building a lighter car (affording more mileage per gallon of gas) that provided added safety for passengers. Nash had always been in the medium-price field; thus any major change in design and construction must not put the final product in a higher-price bracket—it didn't.

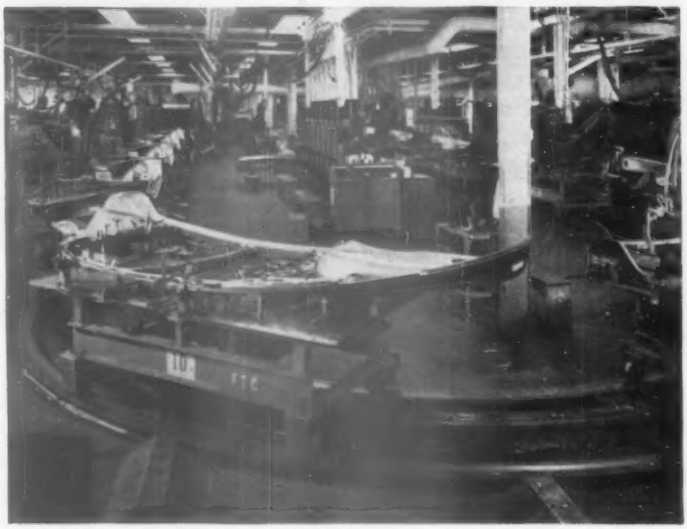


Fig. 2—Spot welds are made on this merry-go-round conveyor to produce the "unisides" or fabricated side subassemblies

Welding the Answer

Company engineers and designers looked at the specifications and conceived the idea of a body and chassis of integral construction. The ultimate result of their thinking was an automobile in which the body would be spot and arc welded into a single unit. Obviously, the procedure would save time by eliminating the bolts and rivets previously required to join the the many parts. It would also greatly reduce costs.

When the Nash "600" rolled off the final assembly line, it would weigh 500 lb less than its

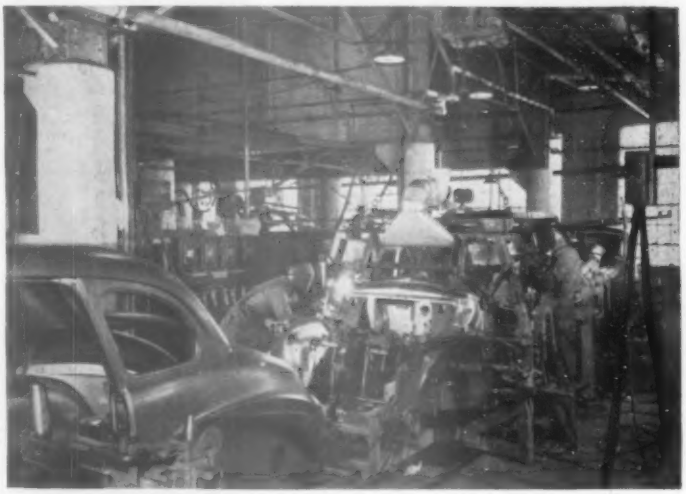


Fig. 3—Tack welding the one-piece roof panel into position. Note the special fixture that is lowered from above

predecessor. For mileage, 25 to 30 miles could be obtained to a gallon of gas when driving at moderate speeds. The Nash "Ambassador," a larger model and big brother to the "600," would not have a unitary body and chassis, but its underbody, sides and roof would be integrally joined.

These were the plans made for the 1941 and subsequent models. Production, however, was short lived because of the Jap attack on Pearl Harbor. Almost immediately, all of the company's equipment was put to work on Pratt & Whitney two-stage supercharged aircraft engines. This production phase continued until July, 1945, when Nash-Kelvinator again made final preparations for automotive production.

Bodies of the "600" are made at the Milwaukee division; engine assembly and wheels are added at Kenosha, Wisc. With warehouses and workshops, the Milwaukee plant spreads over some 1,000,000 sq ft. Production begins on the third floor of the five-story building, where the underbody, a subcontracted assemby, is delivered. The underbody consists of a number of steel stampings joined by arc and spot welding—front and rear pan assemblies, right and left floor side sills, rear motor support bracket, gas tank filler neck cover, stabilizer bar bracket and clutch release shaft bracket. Brackets and braces range from 16 to 11 gauge steel while the front floor pan and side sills are of 19 gauge.

The first production operation at Milwaukee is to weld cross members to the underside. This gives additional strength to the underbody, which will carry a great portion of the final weight. For this and subsequent welding operations, the fabricated unit is set on a large circular conveyor line and slowly moved past numerous stations to receive additional parts—all to be spot or arc welded. These various units have been stamped from Nash presses in another section of the plant and delivered to the third floor production line.

Spot welds are made with various types of automatically controlled portable welding guns. These guns are suspended and counterbalanced from above, so that the aisles and working areas will be clear at all times. Their throat depths range from 1 to 45 in., enabling all weldors to reach the smallest and largest places requiring welds. The spot welds range from $\frac{3}{16}$ to $\frac{5}{16}$ in. in diameter.

Arc welds are made within welding booths to prevent eye injury or other harm to nearby workers. These welds are generally in the form of tacks, ranging in length from about $\frac{3}{4}$ to $1\frac{1}{4}$ in. Mild-steel electrodes are used.

Assembly-Line Procedure

As the underbody journeys down the assembly line, various members are added by weldors equipped with gun-type spot-welding tongs. These members include the rear seat cushion riser panel, rear deck lower panel and tool pan. Only a short time is required to join these sections as the weldors know exactly where and when to place the spots.

Shock absorber housing towers are added when the underbody nears the end of its third-floor tour. The seams holding these towers are arc welded to avoid any possibility of the housing pulling away from the underbody when the car is speeding over rough terrain. The last piece to be joined on the circular conveyor is the dash assembly, which is spot welded to the front floor pan.

The completed underbody is removed from the assembly line to another part of the floor where a rust inhibitor is sprayed on the body side sill panels (Fig. 1). The sill panels will later be joined flush to the "unisides" (fabricated side subassemblies), and some protection must be afforded against oxidation when the two assemblies are fused together and against weathering later on. The panel and uniside, it should be noted, fit so closely that they will not receive the benefit of the rust-resisting "Bonderizing" that is given after the body has been welded into an integral unit.

As shown in Fig. 1, the underbody is now a shallow boat of pressed steel, channeled lengthwise and crosswise by corrugations and strengthened along the edges. At this stage it is ready to receive the two unisides, each a subassembly consisting of side window frame, front wheel house panel, rear quarter side panel, cowl side panel and body side sill panel. These side sections are not formed of one pressed piece of steel but are fabricated by welding together such components as the center pillar

Fig. 4—An elevated platform permits operators to weld without stooping and makes for more accurate work

assembly, outer side roof rail and body side sill panel. Fig. 2 shows the "merry-go-round" conveyor on which the welded side sections are assembled.

Joining of the roof and unisides to the underbody is performed on the fifth (top) floor of the plant. The problem of transporting the welded understructures to the upper floor is solved by an endless conveyor that takes the subassemblies outside of the building, up two floors to the roof and lowers them to the conveyor waiting below. The latter conveyor is fitted with a number of carriages resembling nothing so much as moving four-poster beds. Each of these steel beds is equipped with special fixtures to accommodate the different wheelbase frames and has two sets of locating pins, each corresponding in distance to a particular wheelbase. The holes for these pins were made in the underbodies prior to their arrival at the Milwaukee plant and are sealed by plug welding once they have served their purpose on the conveyor.

The first operation at the top-floor assembly station is the welding of three pieces: dash, sill brace assembly and dash assembly. Spot welds, reinforced by arc welds, are made at the top of the side sill reinforcement and the outer portions of the dash assembly.

The right and left unisides are now placed on the underbody. Fitup must be perfect before the welds are made, and the alignment is assured by special foldovers covering the side sill and body side sill panel. As an added precaution, extra clamps hold the parts flush at vital points.

As the shell progresses along the line, arc welds and spot welds of varying diameters are placed along the body side sill and underbody side sill panels. These joints then form welded flanges. Assembly has advanced sufficiently at this point so that the front wheel house panel may be spot and arc welded to the cowl side and the floor side sill panel extensions. These in turn are joined to the cowl side panel assemblies. Rear quarter side panels are also joined to the underbody at the rear floor side panels and shock absorber housing towers.

Roof Assembly

The fourth and last unit of the welded body is the one-piece roof panel, consisting of front and rear window frames, windshield header bar, cowl top and drip molding. The latter is not integral but is spot welded in place to form a part of the roof.

Nash-Kelvinator has built two special fixtures to position the roof on the unisides—one for the four-door and the other for the two-door model. Both fixtures are equipped with overhead arms, elbows and grippers to assure exact fit-up while a crew of four to seven weldors is adding the one-piece panel (Fig. 3).

When joining the roof to the inner side roof rail panel, it is necessary to use a back-up bar so that the various weld spots will not show through after the roof is finished. Arc tacking is done along the interior to supplement the rows of spot welds. Most of the arc welding is in concealed locations such as the juncture of the cowl top with the cowl side panel and the juncture of the section below the rear window frame with the rear quarter side panel. Arc welding is also used to a great extent in joining the windshield header bar to the side roof inner rail panel and to the top of the front body pillar. The top outside ends of the instrument panel are arc welded to the front body pillar.

The partially completed body moves down the line to permit an oxy-acetylene braze to be made over the spot weld rows that join the roof and cowl side panels and join the roof to the section below the rear window frame. The brazing is done to provide watertight seams and to assure added ductility. The fabricated shell now ends its journey around the framing conveyor and is picked up by an overhead crane and moved to another production line, called the "snake line" because it comprises a series of winds and coils. Since all of the work here is done on the lower portion of the body, a platform has been built about 3½ ft above the floor level to enable the operators to work without stooping. This minimizes operator fatigue and assures more accurate work.

Work on the snake line includes additional spot welds to fasten the rear quarter side panel to the underbody and stabilizer (Fig. 4). Similar spot welds plus several intermittent arc welds are made

(*Continued on page 64*)

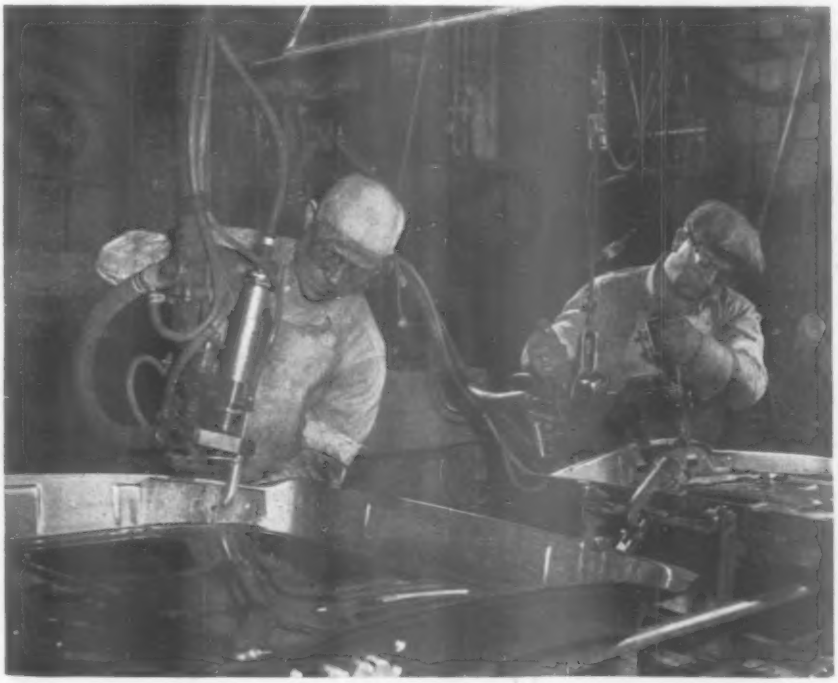


Fig. 5—Inner and outer door panels are spot welded together at their flanges with portable welding tongs

★ RESEARCH

The Hydrogen-Fluorine

Two scientists of the Atomic-Bomb Project turned their talents to the welding field. The result is the hydrogen-fluorine torch that produces the hottest artificial flame ever derived from chemical combustion.

FLUORINE is the most reactive of the 92 naturally occurring elements. All metals at red heat will burn in fluorine in the same way that steel burns in oxygen. Hydrogen or other combustible fuel gases will burn in a fluorine atmosphere as they do in oxygen, but with the liberation of considerably more heat. All of these facts taken together indicate the feasibility of fluorine welding and cutting torches.

In the pure gaseous state, fluorine is a Johnny-come-lately to the "92 club" of chemical elements. It was first prepared by Moissan in 1886 but not studied extensively until O. Ruff carried out intensive investigations between 1910 and 1936. Neither Moissan nor Ruff had appreciable quantities of the gas: Ruff's largest production unit delivered only a few cubic feet in a 24-hour day. Despite this very meager supply of the element, its great reactivity with all materials as well as qualitative indications of its rates of reaction were demonstrated. The work of Ruff still remains the classical work on fluorine chemistry.

USED BY ATOMIC-BOMB PROJECT

When the atomic-bomb project was started, the use of fluorine compounds became a necessity.* Extensive studies of the properties of fluorine and fluorides were started. At Columbia University this investigation was undertaken by the authors, and when their early efforts at storing fluorine in cylinders under pressure were successful, applications of tank fluorine were immediately considered. Prior to this time fluorine had always been used at atmospheric pressure as rapidly as it was produced in the electrolysis cell.

One of the first applications considered for fluorine under the new conditions was its use in a torch with hydrogen. A brief consideration of the reasons for deciding to try a hydrogen-fluorine torch will help to show the reader what is involved.

It has been the aim in practically all welding torches ever developed to produce a flame liberating a maximum amount of heat per unit of gas burned. The hydrogen-oxygen torch has been extensively used to produce a high-temperature-flame, and the standard oxy-acetylene welding torch produces an appreciably higher temperature than the oxy-hydrogen flame. A consideration of the thermodynamics involved shows that a hydrogen-fluorine torch liberates approximately twice as much heat as an oxy-hydrogen torch, with a correspondingly hotter flame.

A second reason for trying to develop a hydrogen-fluorine torch is that many metal fluorides have lower melting points than the metal from which they are produced so that their fluorides will flux the joint as it is welded. This point is especially important because of the excellent fluxing properties of fused fluorides.

A torch of the concentric-tip mixing type was first constructed and is shown in Fig. 1. This produces an intense, bluish-white flame, with which copper, Monel, nickel and steel are readily welded in a very satisfactory manner. This torch, though strictly an experimental one, was used to weld the joints on several copper vessels. It gave very excellent welds. The ease of welding approached that of ordinary oxy-acetylene welding. The quality of the weld on copper compares favorably with high-vacuum copper brazing. The authors are convinced that further development work on such a torch

EDITOR'S NOTE

THE inventors of the new hydrogen-fluorine torch have kindly consented to give readers of THE WELDING ENGINEER an account of their important development. This torch operates on what might be called a revolutionary principle—the burning of hydrogen in a fluorine atmosphere. It is said to yield a flame of over 6,000 F—even hotter than the oxidizing flame of the oxy-acetylene torch.

The hydrogen-fluorine torch has given excellent results in the melting of highly refractory materials. In the welding of copper, for example, it produces a homogeneous weld that compares favorably with high-vacuum copper brazing. Undoubtedly an important place could be found for it in the welding industry, but the fantastically high cost of fluorine offers an apparently insuperable barrier to practical industrial applications.

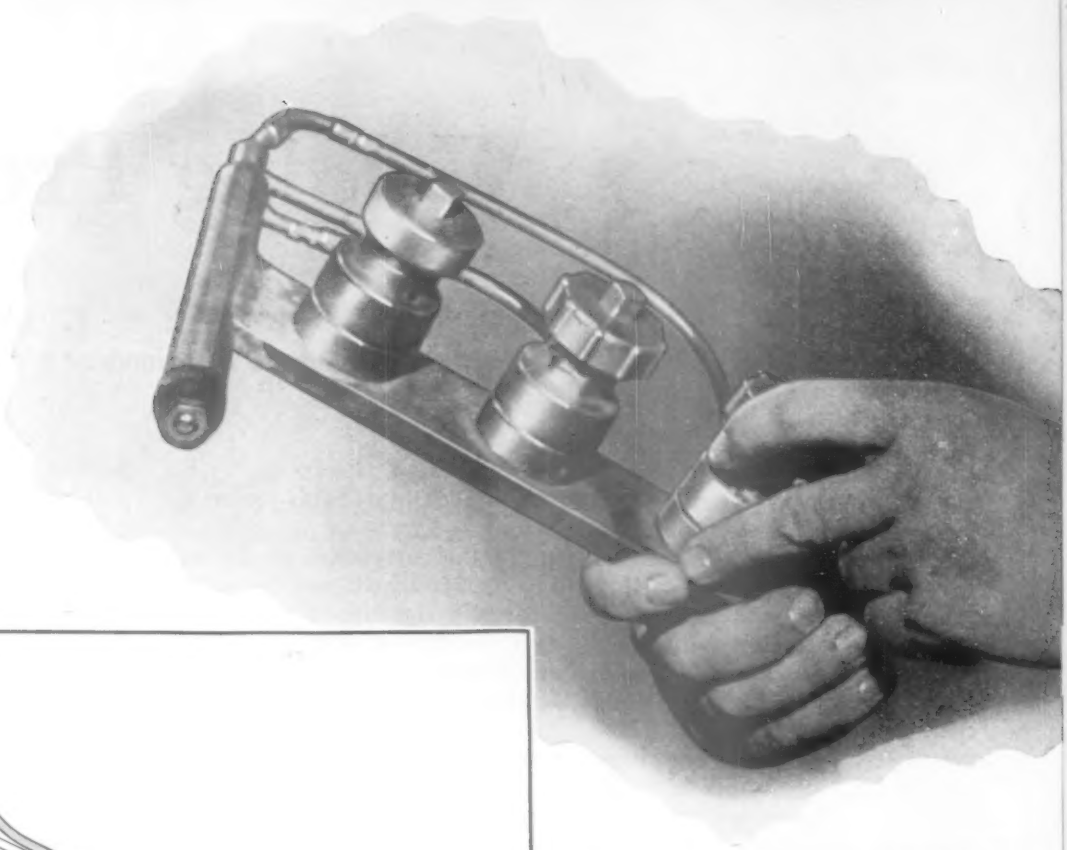
At present a cylinder of fluorine holding only 3 to 4 lb costs $80. A cylinder of oxygen holding nearly 19 lb costs in the neighborhood of $3.50. There seems to be nothing more to say, and yet—

We remember that aluminum was once so costly that it was used only for toys to amuse an emperor. If fluorine gas is ever needed in large quantities, some ingenious soul somewhere will find a way to produce it cheaply. Nothing can be more certain than that.

* The gaseous and thermal diffusion processes for the separation of the U-235 isotope require a gaseous uranium compound. The only one found suitable in the early stages of the Atomic-Bomb Project was uranium hexafluoride, a highly reactive gas that is actually a solid at room temperature and atmospheric pressure.

Torch

BY
H. F. PRIEST
AND
A. V. GROSSE



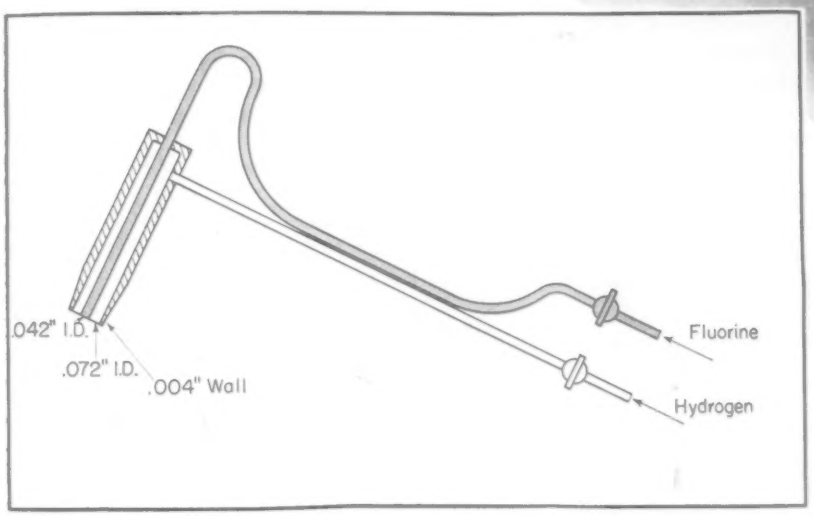


Fig. 2—The more recently developed hydrogen-fluorine cutting torch. This model was first exhibited at the annual meeting of the American Chemical Society in the fall of 1946

Fig. 1—Cross-section of the first hydrogen-fluorine torch. This experimental model gave good results in copper welding

should lead to a very useful tool.

A second interesting point of fluorine, in line with its very great reactivity, is that all metals at red heat burn in fluorine in the same way that steel does in oxygen. This property immediately suggested a "fluorine lance" for cutting such refractory metals as nickel, copper, Monel, stainless steel, etc.

Fluorine Cutting Torch

Work was carried on with the original welding torch, and the indications were that a fluorine cutting torch would be very valuable for work in the copper fabricating industry. Quite recently a cutting torch was constructed that employed two concentric tubes, one to supply hydrogen and the other fluorine for a preheat flame. A center jet of fluorine served as the cutting stream. This torch is shown in Fig. 2. It has performed very well in cutting copper and stainless steel but does not function as well as the oxygen cutting lance with ordinary mild steel.

These, in brief, are the results obtained with the hydrogen-fluorine torch up to the present time. The authors have personally carried out most of this work, and while there is little doubt in their minds that such a torch has good potentialities, there remain many problems to be overcome.

First and most important of these problems is the economic one. At present fluorine is available only in ½-lb cylinders at the fantastic price of $20 per pound. This situation must be improved before the industrial uses of a fluorine torch can even be considered.

A second bugbear is that of transportation. Fluorine has been and is now being transported at pressures below 500 psi. This means that an ordinary gas cylinder would hold no more than 3 to 4 pounds of fluorine and would operate a small cutting torch, such as the one described, for only about two hours at a cost of $80 for fluorine alone.

Finally, careful design of regulators, valves, torches, and exhaust systems must be carried out by some group of engineers who are familiar with the problems of putting such equipment on the market.

The authors would like to state that they feel there is a considerable future for the hydrogen-fluoride torch in the non-ferrous metals industry. The application of this equipment can come about very rapidly if there is sufficient immediate interest to support further work; if not the development will come about naturally with the increase in the industrial applications of elementary fluorine.

★ PRODUCTION

Welding Processes at

Inert-gas-shielded arc welding, flash welding and spot welding are all needed in the manufacture of a modern airplane

T. E. PIPER, chief process engineer, Northrop Aircraft, Inc., Hawthorne, Calif., is convinced that without the various welding processes the modern airplane would lose many of its best characteristics of design, materials and assembly. Manufacturing would be more laborious, inefficient and expensive, nor could the same high inspection standards be maintained.

A few headings taken from the manual prepared to guide welding procedures at Northrop will give an idea of the importance of the various welding practices at the Northrop plants.

Section I—FUSION WELDING. This subject is treated under 30 sub-headings, with 47 illustrations and many tables. It includes gas and arc welding, Heliarc welding, brazing, silver soldering and hard-facing.

Section II—TOOLING FOR MAGNESIUM WELDING. This section covers 14 subjects, includes 19 illustrations and many tables.

Section III—FLASH WELDING. Under this heading are 9 subjects, 33 illustrations, many tables.

Section IV—SPOT WELDING. This is divided into 17 subjects with 54 illustrations and many tables.

The inception of this valuable manual came about in 1943 when Northrop was given the assignment, "Welding, including the welding of magnesium," by the Subcommittee on Methods Improvement of the Aircraft War Production Council. Contributions were made by ten aircraft companies and the American Welding Society.

HELIARC WELDING

The subject of Heliarc or inert-gas-shielded arc welding has been given a rather full treatment in THE WELDING ENGINEER*. For this reason, we will only review the highlights here.

In the early days of the war, the aircraft industry was faced with a drastic shortage of aluminum. Magnesium was considered as a substitute, but it was hard to fabricate, could not be welded satisfactorily because it oxidized too rapidly under a welding torch. How a plain arc weld burns a ragged channel in the joint is pictured in Fig. 1. Northrop technicians under the leadership of V. H. Pavlecka and Russ Meredith developed a new type of welding torch which has a tungsten electrode projecting from a thick tube like the calyx of a lily. The tube supplies helium under pressure to shield the molten metal from oxidation, the flow of helium being regulated by a thumb valve.

This new form of arc torch worked from the first, taking about a third of the time of the magnesium welding method previously used. The inert-gas-shielded arc method was also found equally satisfactory in the welding of aluminum. Later the Heliarc torch was used with a pure stainless-steel filler rod on stainless steel; the resulting welds proved to be stronger than conventional welds in the same metal. This is because the helium acts as a "quencher" to reduce the heat in the parent metal and so minimize the dangers of carbide precipitation.

Heliarc welding permits magnesium sheets, extrusions and tubing to be welded into simple, light and rigid structures. Hundreds of thousands of rivets that go into conventional fuselages can be eliminated. As all aircraft designers know, rivet heads, even when countersunk, produce resistance to passage through the air that requires extra engine power to overcome. The minimizing of "parasite drag" is of great importance

* THE WELDING ENGINEER, September, 1942, "Heliarc Welding"; December, 1942, and January, 1943, "Arc Welding Magnesium Alloys." More recent developments are referred to in the AWS convention report, page 39, January, 1947.

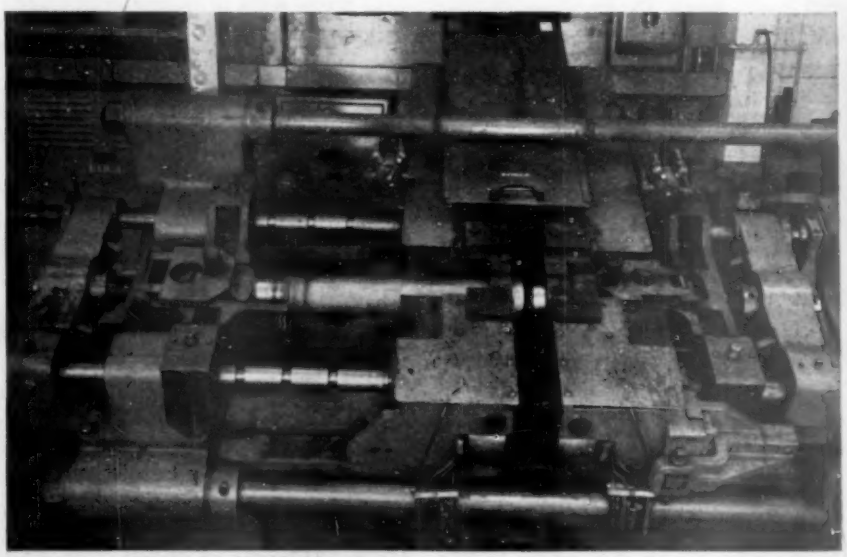


Fig. 5—Flash welding a member for a forward crew nacelle spar. Note upset on completed weld at left. The finished spar is shown in Fig. 6

BY FRED M. BURT

Northrop Aircraft

in postwar aircraft productions, especially with jet-propelled aircraft driven at or near sonic speeds.

Heliarc welding may lead the way to very extensive use of magnesium alloys. Properly processed, these alloys are not inflammable, being, in fact, more resistant to direct flames than aluminum alloys. Magnesium is 35% lighter than aluminum but has a comparable weight-strength ratio; it is 21% the weight of steel. Furthermore, magnesium supplies are inexhaustible; there are nine billion pounds of this flyweight metal in every cubic mile of sea water.

Research is extending use of the Heliarc process to aluminum, brass, Inconel, Monel and some of the carbon-steel alloys. Having five times the specific heat of air, helium prevents heat accumulation around the weld, permits a better fusion and penetration without distortion. The arc is struck with

Fig. 1—Two types of welds in magnesium plate. The ragged channel that may be seen on the left resulted from an unshielded arc weld; the strong, even bead on the right was laid with the Heliarc torch

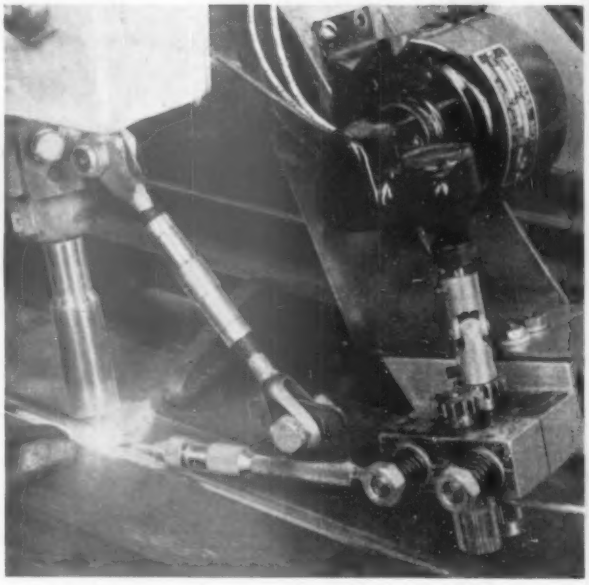
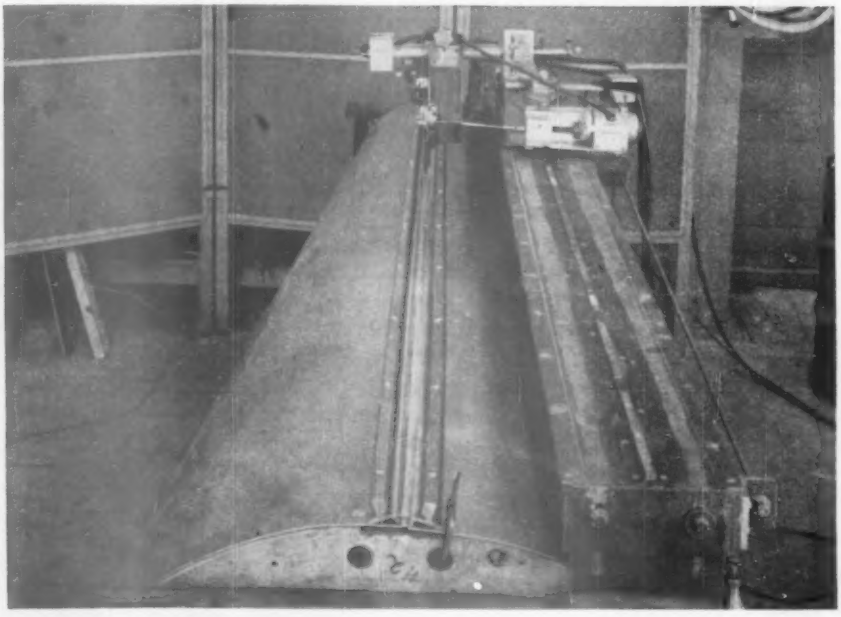


Fig. 2 (right, center)—Automatic inert-gas-shielded equipment in operation. The cylinder carrying the electrode also carries the helium, which is controlled by the thumb valve in the upper left corner

Fig. 3 (bottom, right)—Overall view of the same job shown in close-up in Fig. 2. This long seam was welded at a rate of 12 inches per minute

Fig. 4—Current-carrying dies on the 400-kva flash welder. This is the largest one at Northrop Aircraft



a light brushing action and then quickly withdrawn from the metal.

The torch may be used for pencil welding, or a handlebar grip obtained for heavier welding by extending the handle. Equipment has been developed that will feed the filler rod automatically. A close-up is shown in Fig. 2, while Fig. 3 gives an overall view of a completed job welded at a speed of a foot per minute.

Better results are obtained by feeding the filler rod into the heated tungsten electrode (which melts the filler metal) than by feeding it into the molten pool under the arc. The latter method does not agitate the pool sufficiently to break the crust that forms on its surface. Since the heat reflected from the tungsten is apt to overheat the filler rod, an angle of from 60 to 90 degrees must be maintained between the rod and electrode. The torch must be held as near the weld as possible; optimum arc length is 0.060 in. Poor penetration or gas holes may result from using too long an arc. On alloys having a tendency to be hot short, a rapid welding speed, say three feet per minute, is recommended to prevent cracking.

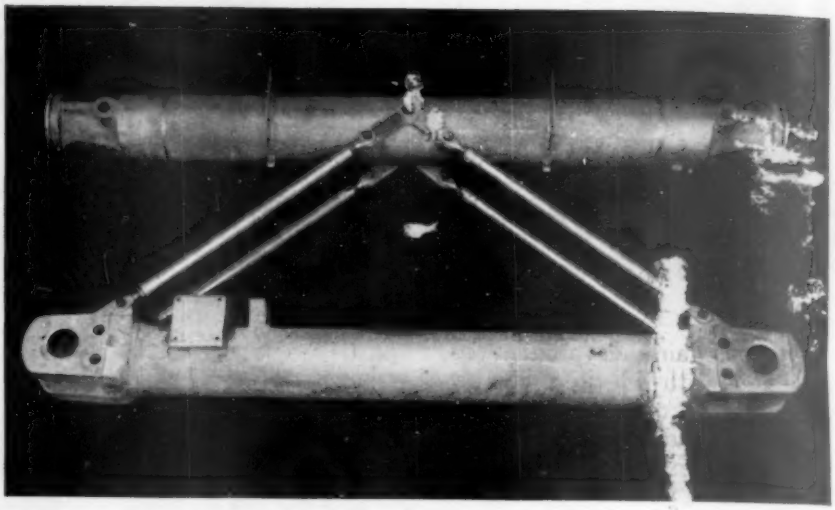


Fig. 6—The completed nacelle spar. The two flash welds in the bottom member (close to ends of cylindrical section) are those made in Fig. 5

The average life of a 200-cu. ft tank of helium is about 35 hours for continuous welding with a medium-sized torch. Fairly pure helium is required; impurities such as carbon dioxide, hydrogen, nitrogen and the methane series of hydrocarbons may cause pronounced defects. Argon is also successfully used for inert-gas-shielded arc welding and offers some advantages.

Flash Welding

Flash welding is highly important in aircraft production for the assembly of tubular components. In its essentials, the flash welder consists of one stationary platen and one movable platen mounted on accurate ways. An automatic drive that may be set to precision values is incorporated to control the motion of the movable platen. Current-carrying dies (Fig. 4) are mounted on both platens and connected to a transformer so that each set of dies will be of opposite polarity.

Each of the two parts to be

Dwg. Title 550891
Dwg. No.
Process Engineering Approval
Tentative Date
Final Date 11/26/45

Material Description 3.25 x .120 1020 Steel Tube
Machine to be used 400 KVA
Tooling to be used
Area of cross-section at weld (Sq. In.) 1.18
Final Die Space .31 - 210
Total Loss per Weld .56
Can or Template No. G-18615 Dial Setting 18
Upset 24.4 - 0
Speed Setting 3-8
Transformer Tap 1-1-8 Phase Shift Dial 20
Current Off 20 Cycles

Additional Machine Settings - To be made in the Order Given:

1. Hydraulic Pressure 1000#
2. Air Pressure 55#
3. Argon Gas 5#
4. (Argon gas is used only on large sections requiring high heat-
5.
6. treat. It produces an inert, non-oxidizing atmosphere aroung the
7.
8. weld, which is a difficult one. The argon gas will minimize
9.
10. defects. The burning metal(flash has an affinity for Oxygen. The more Oxygen there is present, the more the likelihood of weld

Sketch of Drawing: defects.

ORDER NUMBER	SERIAL NUMBER	NUMBER OF PARTS	DATE	OPERATOR	INSPECTION SET-UP CHECK

Northrop Aircraft, Inc.

Fig. 7—Flash-weld operation card. After the tests have proved satisfactory, the welding procedure is permanently recorded on this comprehensive card

welded is clamped in its dies so that it protrudes towards the other part in accurate alignment. Suitable back stops or locating fixtures may also be mounted on the platens. An alternating current of high amperage but low voltage is applied as the one part is moved towards the other. When the parts come close enough, an arc is formed that causes an intensely brilliant flashing to occur. This provides both heating and a cleaning action. Flashing is maintained for a carefully controlled number of seconds, and then the heated parts are suddenly pressed together and forged under pressure. Fig. 5 shows a nacelle spar immediately after flash welding and Fig. 6 the completed product.

Once a flash welder has been set up, it repeats each cycle in nearly an identical manner. Control adjustments are provided for current magnitude, travel time, distance traveled during the flashing period, platen speed at any point in the cycle and at the time at which the current is turned off.

Capacities from 20 to 400 Kva

One size of machine is inadequate to cover the entire range of applications. Northrop has three, which provide a wide range without much overlapping. The largest machine is a 400-kva unit capable of welding two pieces of 4130 steel of cross-sections up to about 4 sq in.; welding time including both flashing and upset runs up to 25 seconds.

The next smaller machine is of 100-kva capacity and will handle 0.67-sq-in. cross-sections in about four seconds. The third machine is a 20-kva unit for cross-sections on the order of 0.16 sq in. in times of 1½ to 3 seconds.

Linear tolerances of $\pm\frac{1}{32}$ in. are maintained on flash-welded assemblies. Sheet, plate, tubing and bar stock and even eccentric shapes can be fabricated if within the size limitations that can be handled in the special dies that fit these machines.

There are two other 400-kva flash welders in the Los Angeles industrial area (at Douglas and Bendix) and one 1,000-kva unit, used largely for oil-well tool work.

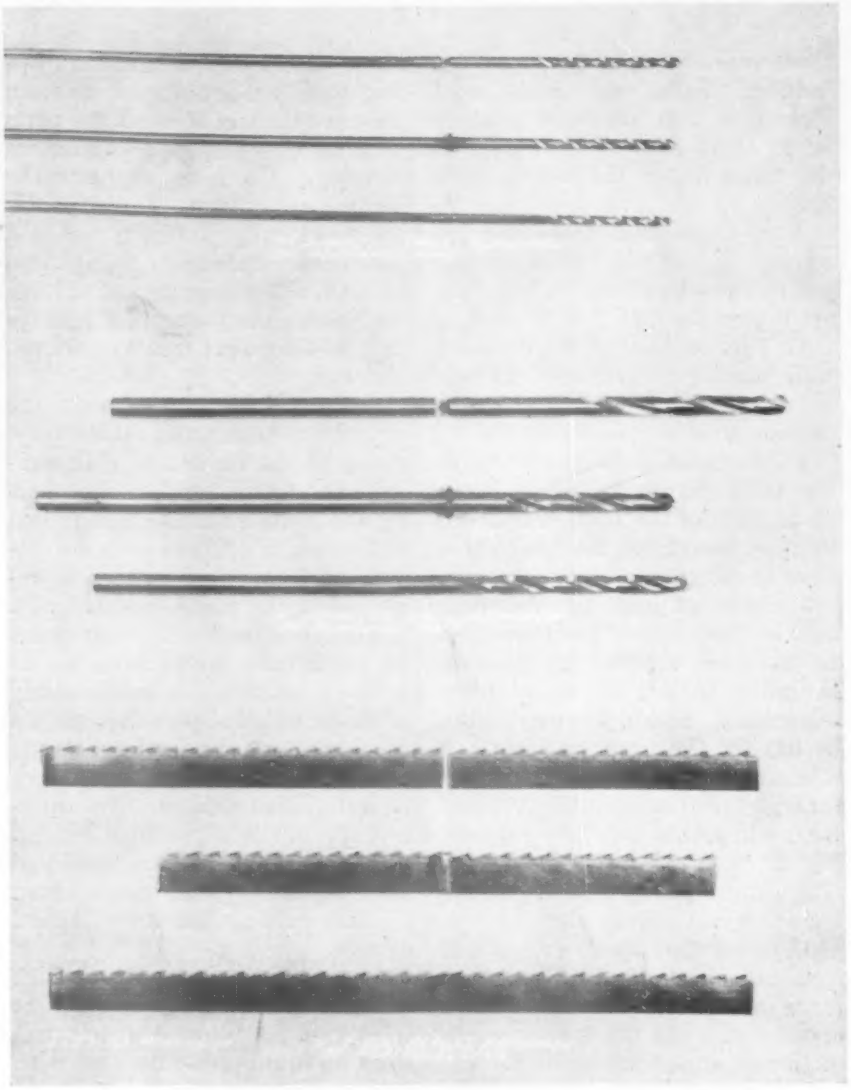


Fig. 8—Drills and hack-saw blades prior to welding (upper of each set), as-welded and after grinding. This is a quick way to repair broken tools

An interesting Northrop flash-welding job was the production of 100,000 tubular collars for 5-in. rockets. These were supposed to be made from thick-wall (⅝ in.) tubing of $5\frac{1}{16}$-in. OD, but such tubing just wasn't available. So ⅝-in. plate was cut to size and formed into half-sections that could be matched to make the short tubular collars. The two halves were speedily flash welded together. After the rough ring of metal that mushed out at the line of junction had been machined, evidence of the weld was practically indiscernible.

The flash-welding production rate is fairly high. Two welds per minute are not exceptional for small parts, while 15 to 20 welds per hour can be expected on larger parts. This rate gives rise to frequent set-up changes since the number of like parts is not often large.

The crew nacelle spar (lower, larger unit in Fig. 6) has two large members of SAE 4130 (chrome-moly) steel tubing. Each of these has two flash welds close to the ends of the tubing. These welds have to be of sufficient (and certain) strength to permit wings to be attached to each end of the spar. Exhaustive tests have proved that the flash welds can be accepted as having 100% the strength of the parent metal. When the spars were previously arc welded, it was necessary to make them of heavier material as arc welds could provide only 75% of the strength of the unwelded tubing.

Two men could make five of

these spars in eight hours by arc welding. Using the flash weld technique, two men now produce 50 in eight hours. The speed is ten times faster, the weight 25% lighter.

A recommended procedure for setting up a new flash-welding job will now be given. The values are typical for SAE X4130 steel.

1. Test coupons of the material to be welded are prepared. These are cleaned by sandblasting to provide good electrical contact.

2. The machine is set up to give the total travel required. From 20 to 35% of the total travel will be upset travel, but the exact value must be determined experimentally.

3. On most jobs, the clamping dies in their closed position must be as near together as possible in order to aid in maintaining alignment. Space, however, must be left for the upset to form. A minimum value for this is $\frac{3}{16}$ in. for wall thicknesses under 0.04 in.; for each additional 0.04 in. add $\frac{1}{64}$ in.

4. Adjust the speed and current for steady, vigorous flashing. A good preliminary speed setting will cause the flashing travel to take place in a time equal in seconds to about five times the area of cross section in square inches.

5. For some parts, particularly those with a wall thicker than $\frac{1}{16}$ in., some benefit may arise from beveling the end of one of the parts as is done to prepare joints for arc welding. The exact shape of the bevel is not critical. Its purpose is to avoid two perfectly matched machined surfaces coming into contact, since these are apt to have such good current-carrying capacity that flashing will be prevented from starting.

6. Trial welds are made until the external appearance is satisfactory. Some of the welds are then subjected to tensile tests, while others receive metallurgical examination. If the results of these tests are satisfactory, the final setting is recorded on the set-up card (Fig. 7).

Flash welding is still pretty much in its infancy in relation to its future potentials. A careful study of characteristics, plus the analysis of satisfactory applications, should point the way to many logical new uses for the process. An interesting example is provided by Fig. 8, which shows broken drills and hack-saw blades that were rejoined by flash welding and made as good as new.

The writer is indebted to Jack Graux, flash weld engineer at Northrop, for several demonstrations and interesting data on both flash and spot welding.

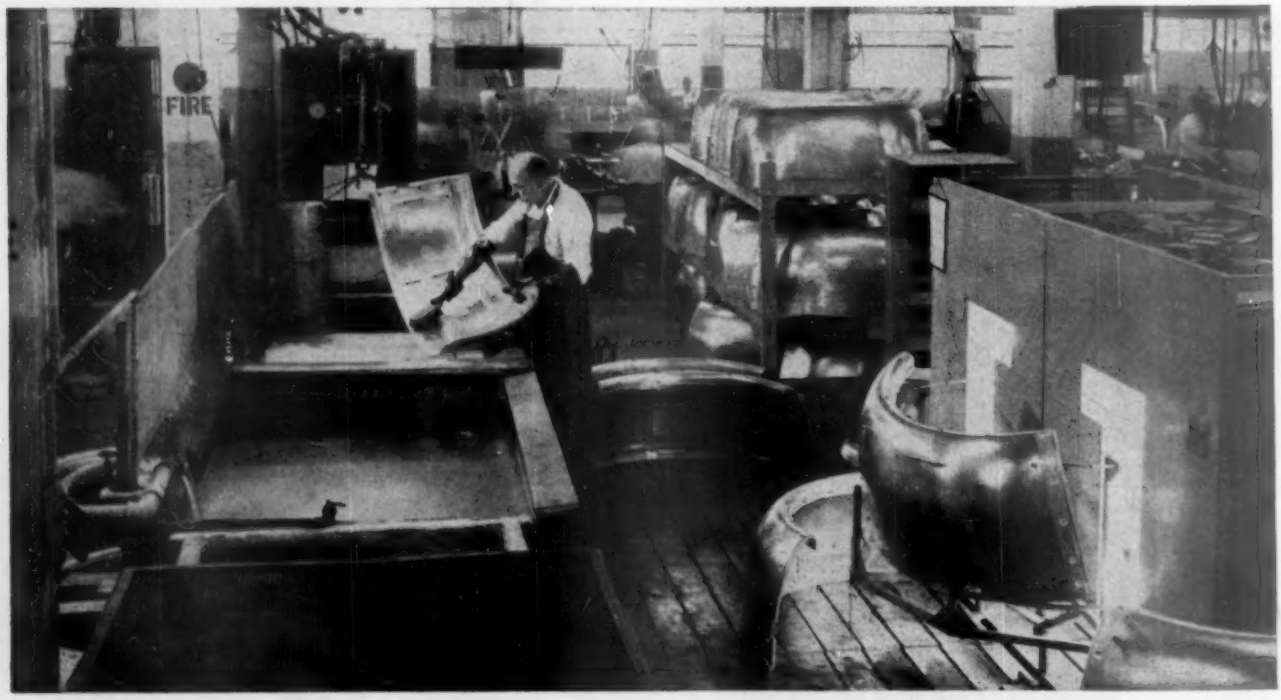
Preparation for Spot Welding

Small assemblies (of aluminum alloys) are prepared for spot welding at Northrop in an unusual manner (Fig. 9). Instead of handling each small part separately through the deoxidizing bath and then assembling them prior to spot welding, they are precision joined and held together by whatever clamping attachment device is indicated before they undergo preweld etching.

The aluminum-alloy assemblies go first into a phosphoric-acid solution. This leaves a slight smudge, which is removed, after a water rinse, in a weak hydrochloric and chromic acid bath. This is followed by another rinse and drying. Welded assemblies given this preweld cleaning treatment show no signs of corrosion, even after long exposure to the weather.

In making the spot-welding machine settings for a specific production job, past experience from running parts of the same or similar specifications is drawn upon. In preparing the welding schedule, reference is made to the spot-welding control chart for the particular alloy and gauge thickness concerned. On this chart, average values for test samples have been plotted.

Fig. 9—Rinsing and cleaning tanks used to prepare aluminum-alloy subassemblies for spot welding



SPOT WELDING SCHEDULE FORM 2

Company Northrop Aircraft, Inc. Address Hawthorne, Calif. Date 11-20-45

Machine Make Acme Serial No. 2233 KVA 50

Sheet Combinations							Part Number	Part Number
TOP	Alloy No.	5W						
	Gage	021						
	Condition	D						
BOTTOM	Alloy No.	5W						
	Gage	042						
	Condition	D						
INTERMEDIATE	Alloy No.							
	Gage							
	Condition							
Specification Shear Strength		440						
Weld Button Dia.		160						
Electrode Dia. and radius	Top 3/8	2"						
	Bottom 3/8	2"						
Distance Between Arms		6 3/8"						
Throat Depth		34"						
Weld Time		8						
Hold Time		8						
% Phase Control of Heat No. *								
Gage Pressure (lbs.)		103						
Electrode Pressure (lbs.)								
Condenser Voltage								
Primary Voltage								
Resistance Blocks in Circuit								
Squeeze Pressure	Lbs.							
	time (sec.)							
Weld Pressure	Lbs.							
	time (sec.)							
Forge Pressure	Lbs.							
	time (sec.)							
Bellows Setting								
No. Condensers at MFD		AA						
Condenser Switch Settings		A3						

*Phase control or condenser voltage may be changed up to 5%

WELDING WITNESSED BY: APPROVED BY:

Machine Opr. Seth Jenkins Process Eng.

Welding Sup'r. B. Kaun Customer

Fig. 10—One of the spot-welding schedule forms used at Northrop Aircraft

The form used for spot-welding schedules (Fig. 10) provides space for the entry of such data as: alloy number, gauge, condition, specification shear strength, weld button diameter, electrode diameters (top and bottom), distance between arms, throat depth, weld time, hold time, percent phase control of heat, electrode pressure, condenser voltage, primary voltage, resistance blocks in circuit, squeeze pressure (lb and time), weld pressure (lb and time), forge pressure (lb and time), bellows setting, number and capacity of condensers, condenser switch settings.

At least ten preliminary tests are made, using three sample pieces of the same material as the production work. These are thoroughly checked before the exact schedule and procedure is set up for productive operations. Every half hour during production runs, three more test samples are tested. This preparation and regular checking insures that uniformly satisfactory spot welds will be obtained.

A typical welding cycle is as follows:

1. The parts to be welded are cleaned so that no additional resistance to the flow of current will be caused by foreign matter. Electrode tips must be clean for the same reason.
2. Proper adjustment of pressure is made.
3. Heat control is adjusted so that the correct amount of current will be applied.
4. The length of time for which the current will flow is set.
5. Pressure is applied to the work.
6. Switch is closed.
7. The current is now on, and the metal between the electrodes is heated to (or beyond) the point of fusion.
8. The switch is opened.
9. The metal is allowed to cool and freeze while under pressure.
10. Electrode pressure is released.

If a satisfactory weld does not result, it may be caused by any of the following variables: unclean surface of part or electrode tip, incorrect setting of welding current or time, improper pressure, incorrect pressure time.

Since the soundness of a spot weld is often not visually apparent on the surface, it is necessary to check the welds periodically by taking samples and either testing them for shear strength or examining them under the microscope. These periodic tests check both the consistency of the operator and the operation of the welding machine.

An interesting little welding job at Northrop was the seam welding by spot welding of 032-61 SW aluminum-alloy sheet used to make a pressure vessel. The specifications called for a vessel that would not leak under at least 30 psi pressure. A seam-sealing compound was diluted to spraying consistency with a solvent and sprayed on the surfaces to be joined. The formed assembly was then jigged and spot welded on ½-in. centers.

All-Welded Stack

Largest of its kind in the U. S., this 250-ft welded stack was fabricated at Ingalls Iron Works, Birmingham, Ala., for the National Carbide plant at Louisville. Its diameter measures 22 ft at the base, 15 ft at top

WELDING Is His Hobby

Most weldors are in their trade for pay, but here is one who welds for fun. However, he makes money out of his unusual hobby.

HAROLD L. FOUTS, Canton, Ill., is the fortunate possessor of a hobby that sustains itself financially and even, at times, returns an appreciable profit. He devotes most of his spare time fabricating miscellaneous equipment for his home or in tackling neighbors' maintenance problems with his welding machine.

After he had converted 1,200 square feet of floor space at his home into a workshop, Mr. Fouts found that welding was indispensable to the successful fulfillment of his projected activities. So he purchased an arc welder and taught himself how to use it. The neighbors also became interested, and Mr. Fouts is able to pick up enough outside jobs to more than defray his shop expenses.

For his own amusement, he turns out costume jewelry made from stainless steel, letter openers, napkin rings and a wide variety of other small welded items. On the heavier side, he has fabricated an all-welded bench for his turning lathe (Fig. 1) and built an all-welded power lawn mower (Fig. 2). He also uses his arc welder to repair broken metal items around the house.

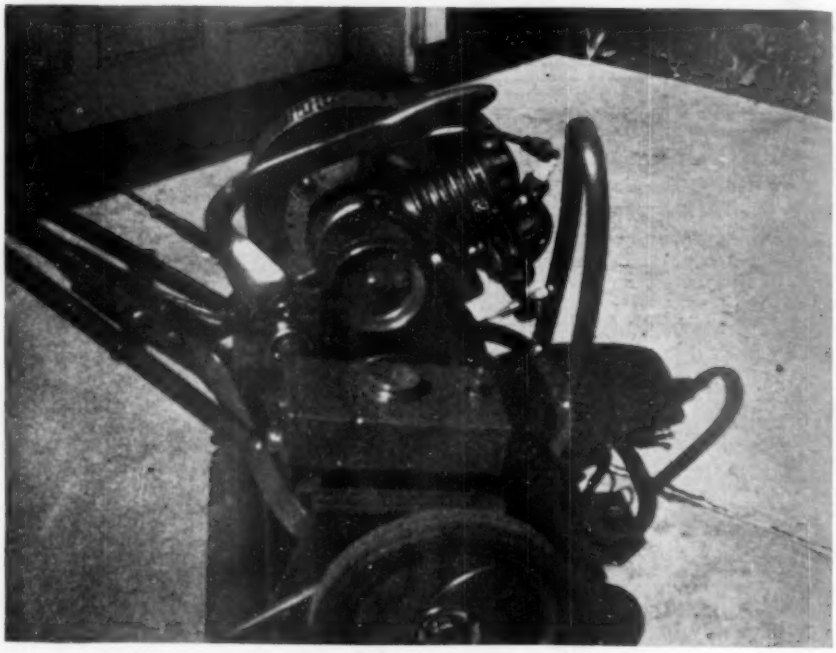


Fig. 2—Mr. Fouts built this power lawn mower. He also uses his home arc welder to make smaller items such as napkin rings and costume jewelry

Photos courtesy The Lincoln Electric Co

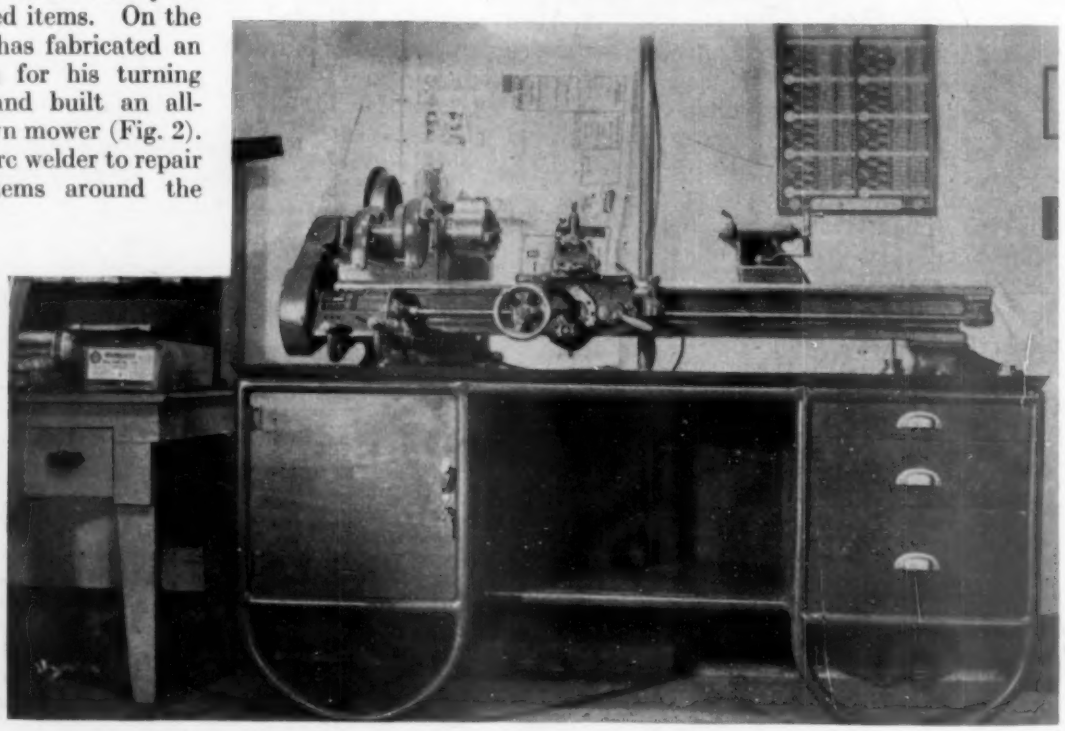


Fig. 1—This all-welded bench was designed and built by Harold L. Fouts, Canton, Ill., for his workshop lathe

Flame-Cutting Plates for Welded Ships

More careful planning of the job in its entirety assures edges for shell and deck plates beveled to fit the particular welds required. This simple system has paid for itself many times over at Ingalls Shipbuilding Corp.

BY MILTON FORMAN*

ONE of the most important prerequisites for high-quality, economical welded ship construction is the proper edge preparation of shell and deck plates. This involves the careful design of the plate edges for the type of welding operation, manual or automatic, which will join the plates at a minimum cost and with the highest quality.

It is naturally desirable that all possible work in preparing these edges be done at the time the plates are laid out and fabricated. Plate edge preparation done on the welding platens or on the hull is very expensive and is never up to the high quality which can be achieved when the cutting is done under ideal shop conditions. Keeping these facts in mind, the

★ CONSTRUCTION

Ingalls Shipbuilding Corp. reviewed every aspect of plate edge preparation for welding and developed the system outlined in the present article. This system has been in use for years and has proved itself to be highly successful.

We found that 18 types of joints will cover all the conditions encountered in ship construction. In general, these joints can be divided into three groups:

Group I includes plates to be welded on both sides by the automatic process. All preassembly welding is in this group—shell assemblies, bulkheads, deck assemblies, etc.

Group II consists of plating to be manually welded from one side and welded by the automatic process on the second side. In this group are the flat bottom shell erection welds and the erection welds of the inner bottom plating.

Group III includes all manual welding on the hull. All plates up to and including 1 in. thickness in Group I are square edge and are shown in joints No. 3 and No. 5 of Fig. 1. Since these joints are to be welded completely by the automatic process, a tight fit is re-

* At the time this article was written Mr. Forman was welding engineer of the Ingalls Shipbuilding Corp., Pascagoula, Miss. He is now welding engineer of the Emsco Derrick & Equipment Co., Los Angeles.

Fig. 3 (above)—Match-mark chalk lines. These lines are to be brought together when the plates are fitted

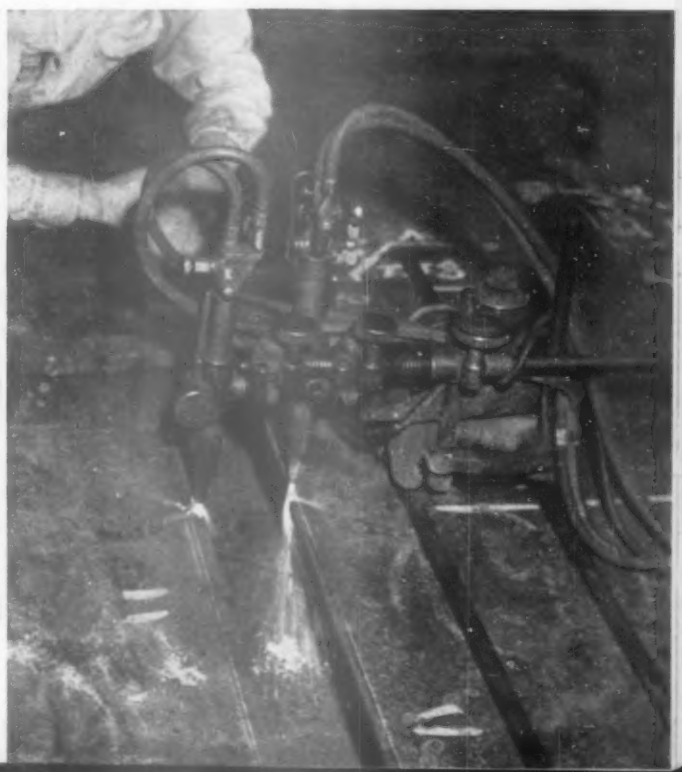


Fig. 2 (right)—Parallel flame-cutting. Two plates are cut to matching contours with two torches on a single arm

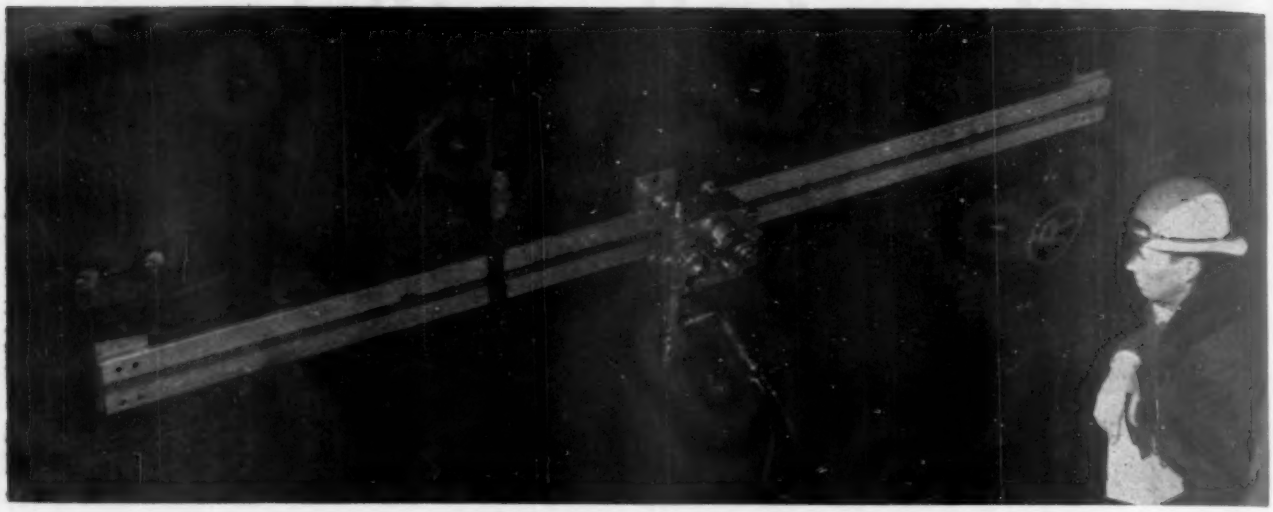


Fig. 6—Lightweight cutting machine in operation on a side shell. This machine will do horizontal, vertical and overhead flame-cutting. Careful planning keeps to a minimum the cutting that must be done on the hull

quired. The gap should not exceed $\frac{1}{16}$ in. Therefore, in all cases, the plates are to be "parallel" flame-cut, a process which will be described later. Parallel cutting not only supplies the ideal tight fit for automatic welding, but it also reduces the cost of fitting because the plates are match marked. The mere act of lining up the match markings and pulling the plates together provides the tight fit, without any need for trimming the edge of the plates in order to bring them together.

Group II, as typified by joints Nos. 1, 2 and 4, allows for a minimum of manual welding, yet a sufficient amount of weld metal is to be deposited to act as a back-up for the top side automatic weld. The latter is deposited with a high heat, up to 1,200 amp being used at times.

Group III includes both the single-bevel and double-bevel joints for manual welding. The single bevel is used for thicknesses up to $\frac{3}{4}$ in., but plating of greater thickness requires a double bevel in order to balance the welding and minimize distortion. The double bevel also reduces the amount of weld metal to be deposited.

It is to be noted that on the horizontally welded seams, as shown in joints Nos. 10, 11, 12 and 14, the standard 60-deg included angle has been reduced to 50 deg. The lower plate is given a 20-deg bevel. This procedure supplies an excellent joint design for welding and eliminates a substantial amount of weld deposits.

Once the above mentioned joints were standardized and drawn up, copies of Fig. 1 were issued to all departments involved in the preparation of plate edges. The next step was to guarantee the proper preparation and arrange that all possible work be done in the fabrication stage.

Co-ordination with Hull Department

As soon as the approved deck and shell plans have been issued by the engineering department, the welding engineer meets with the hull department to determine the size and type of assemblies. Three factors warrant major consideration; namely, the design of the deck and shell plating in relation to the beam and framing connections, maximum crane capacity available and overall cost of assembling and erecting the assembled units.

Once the assemblies are determined, the locations for leaving extra stock are agreed upon, and the welding engineer marks up the deck and shell drawings for size of assemblies, type joints for edge preparation and extra stock. The mark-up shell drawing is then sent to the mold loft.

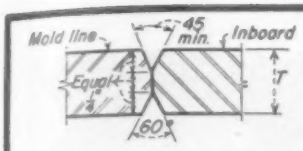
Wherever parallel flame-cutting is required, the seam is marked with two parallel lines. The seams are also marked by the welding engineer so that the bevel will be on the most convenient side for welding. All manual welding below the tank margin calls for the bevel on the inboard side. This will allow the gouging operation to take place on the outside of the hull and also allows the greater part of the welding to be done in the downhand position. On the side shell, where there is plenty of room inboard, the bevel is placed on the outboard side so that maximum production can be achieved with minimum interference.

It is to be emphasized that all of the above is completely determined before the plates are fabricated. It is only because the details of welding are determined at this early date that a maximum of plate edge preparation can be done in the fabrication process and not on the hull, where it is very expensive.

After the deck, shell and bulkhead drawings have been marked up, the mold loft includes the required joints on the bills and the templates. All tabulated plates which do not require templates are enumerated on the mold loft bill, and each plate edge is identified

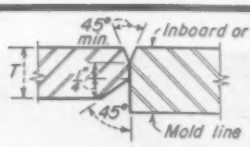
→

Fig. 1—Ingalls Shipbuilding Corp. issues this joint-type chart to all departments involved in preparation of plate edges. The 18 standardized joints cover every condition found in the construction of decks, shells and bulkheads for ships



Manual weld - outboard
Submerged melt weld - inboard
A - flat keel erection butts

No. 1



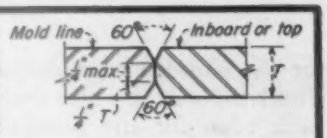
Manual weld - outboard side
Submerged melt - inboard side
A - flat keel to "A" strake

No. 2

Note:
Butt edges of both plates to be duplicate flame-cut.

Submerged melt - both sides
T - $\frac{5}{8}$" maximum
A - tank top plating pre-assembly joints
B - all pre-assembled shell plate seams

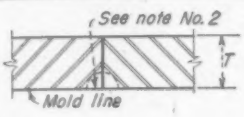
No. 3



Manual weld - outboard side
Submerged - melt weld - inboard side
T - more than $\frac{1}{2}$" plate

A - flat bottom shell erection joints

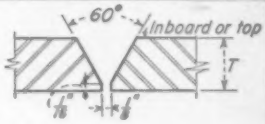
No. 4



Note:
1. *Butt edges of both plates to be duplicate flame-cut*
2. *After seal bead is submerged melt welded gouge to $\frac{3}{8}$" shoulder.*

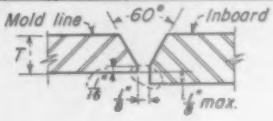
Submerged melt - both sides
T = more than $\frac{5}{8}$" plate
A - shell plate pre-assembly joints

No. 5



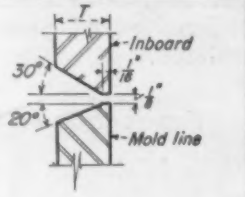
Manual weld - both sides
T = $\frac{3}{4}$" max. plate - $\frac{5}{16}$" plate min.
A - shell plate below tank margin erection joints
B - longitudinal girders below tank top

No. 8



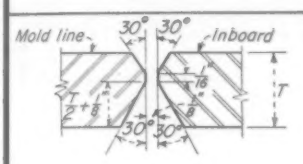
Manual weld - both sides
T = $\frac{3}{4}$" plate max. - $\frac{5}{16}$" plate min.
A - shell plate below tank margin erection joints

No. 9



Manual weld - both sides
T - $\frac{3}{4}$" plate max. - $\frac{5}{16}$" plate min.
A - shell plate - erection seams only above tank margin

No. 10

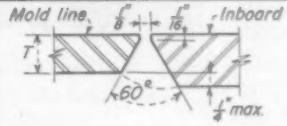


Manual weld - both sides
T = more than $\frac{3}{4}$" plate
A - shell plate erection butts only
B - deck plate erection joints

No. 13

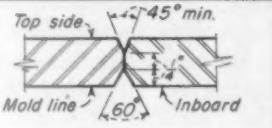
Manual weld - both sides
T - $\frac{3}{4}$" plate max. - $\frac{5}{16}$" plate min.
A - shell plate - above tank margin
B - deck plate - erection joints

No. 15



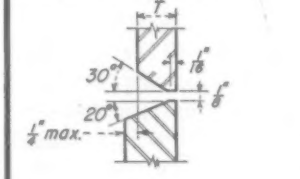
Manual weld - both sides
T = $\frac{3}{4}$" plate max. - $\frac{5}{16}$" plate min.
A - shell plate above tank margin erection butts only. Butts of unequal plate thickness.

No. 16



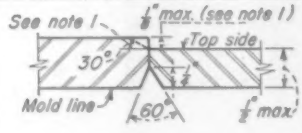
Manual weld - bottom side
Submerged melt - top side
A - tank top erection butts

No. 6



Manual weld - both sides
T = $\frac{3}{4}$" plate - max. - $\frac{5}{16}$" plate - min.
A - shell plate - erection seams of unequal plate thickness

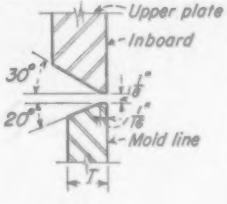
No. 11



Note:
1 - *When plates differ more than $\frac{1}{8}$" thickness, bevel thicker plate as indicated.*

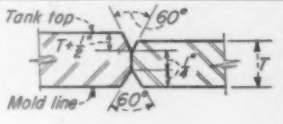
Manual weld - bottom side
Submerged melt weld top side
A - rider plate to tank erection joint

No. 17



Manual weld - both sides
T = $\frac{3}{4}$" plate max. - $\frac{5}{16}$" plate min.
A - shell plate erection seams of unequal plate thickness

No. 12



Manual weld - bottom side
Submerged melt - top side
T = more than $\frac{1}{2}$" plate - joints of unequal plate thickness
A - tank top erection joints

No. 7

Note:
1. *Bevel plates as shown in (a), (b) and (c) when difference in plate thickness exceeds $\frac{1}{8}$" on root side, or $\frac{1}{4}$" on groove side.*

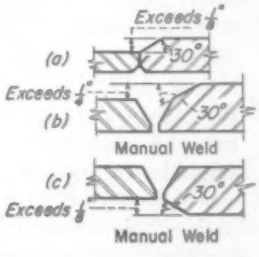
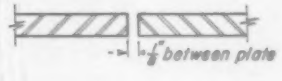
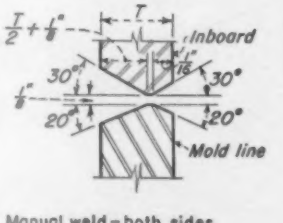


Figure 1



Manual weld - both sides
T = $\frac{1}{2}$ plate max.
A - butts and seams in dk. and bhd. pltg.
B - butts in girders and web frs.

No. 18



Manual weld - both sides
T = more than $\frac{1}{2}$" plate
A - shell plate - erection seams only

No. 14

for the suitable edge preparation. The templates are also marked on each edge for the required edge preparation. In this manner, all work coming out of the mold loft gives complete information for the fabrication of the deck, shell and bulkhead plating. The work of the mold loft affords a guarantee that the maximum amount of fabrication will be done at a lower cost and at locations where greatest uniformity and precision can be achieved.

Fabrication of Plating

The fabrication shop, in laying out the plates, makes a sketch of the required bevel on the steel plate. When the plates are put on the cutting tables, all information is easily interpreted by the operator and there is little room for error. Standard straight-line and shape cutting machines are used. In the case of parallel cutting, two torches are mounted on one arm. The machine is guided along the line to be cut, and any irregularities in one plate are reproduced to the opposite hand on the other plate. Fig. 2 shows a machine in the act of parallel cutting.

After the plates are cut, a line is struck perpendicular to the edge, and a center punch mark is made on each plate on the line. The match-mark chalk line is shown in Fig. 3. The shipfitter brings the two match marks together so that they line up, and he encounters no difficulty in pulling his plates together for a tight fit. Nor does he have to ask the aid of a flame-cutting operator to trim portions of the plate in order to bring them closely together.

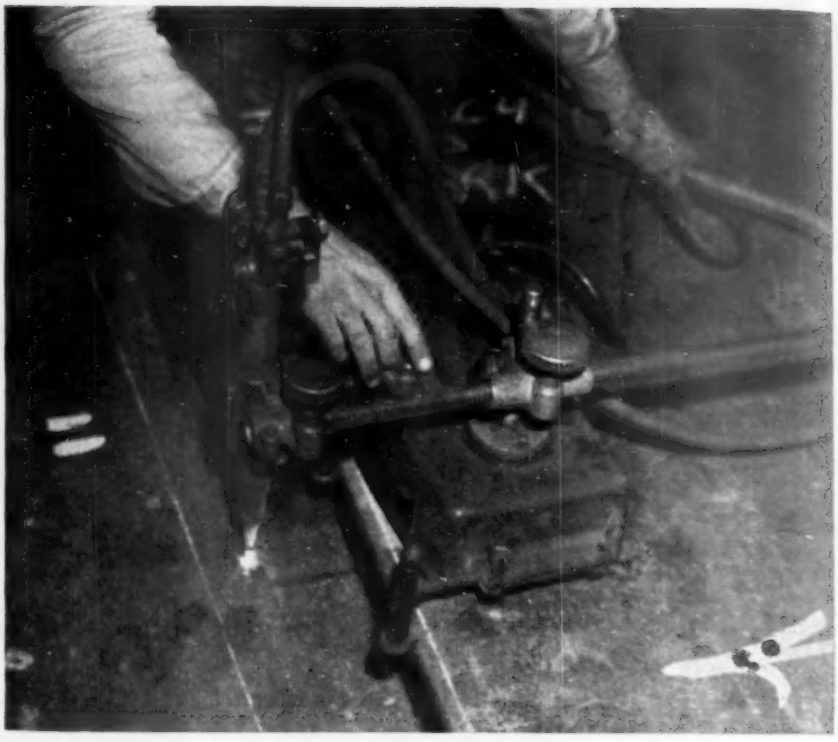


Fig. 4—Duplicate flame-cutting. The side roller attachment follows the "neat" plate to remove the excess stock left on the other. The effect is the same as in parallel flame-cutting (refer back to Fig. 2)

In some cases, one of the plates is "neat" and the adjoining plate has extra stock. When this occurs Ingalls uses the method of duplicate cutting. This is done by placing on the cutting machine a side roller attachment which follows the neat plate (see Fig. 4). The torch then cuts the plate with extra stock so that it is identical with the neat plate. In effect, the same result is achieved as in parallel flame-cutting. In all cases where automatic welding is not done on both sides of the plate, standard multiple torch set-ups are used to trim and bevel the plate in one operation (Fig. 5).

Where deck, shell and bulkhead joints are to be cut on the ways, machine cutting is used whenever possible. For shell joints, a light, portable machine developed by Higgins Industries is used. This machine (Fig. 6) can operate in the horizontal, vertical and overhead positions.

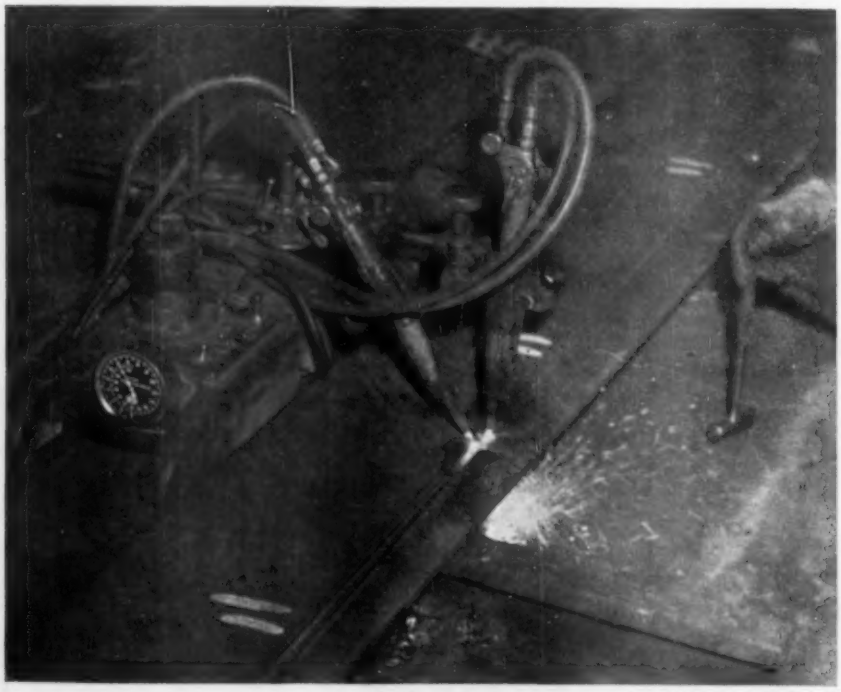


Fig. 5—Trimming and beveling is done in one operation with a standard two-torch set up. Three torches can be used if a double bevel is required

Fig. 1—All-welded carriage for a 40-mm antiaircraft gun in traveling position. The four pneumatic-tired wheels are removed when the gun is in operation

Fig. 2—Carriage for the 40-mm antiaircraft gun in firing position. The platform rests on the four screw-operated jacks and is anchored by the stakes

Welding Military Equipment in Britain

★ PRODUCTION

BY E. DACRE LACY

The war has been over for more than a year and a half, but its production lessons should not be forgotten. It is interesting to note that the experience of our British cousins with welding closely parallels our own.

ONLY two types of British light wheeled armored vehicles were welded at the outbreak of the war. At the termination of hostilities, however, every armored vehicle produced in Britain incorporated an all-welded hull and turret. And all postwar construction is based on welding.

The mounting figures of production are of historical interest. In 1940 Great Britain produced 1,397 tanks; in 1942 (before welding was fully introduced) 4,944; in 1943 (when welded production was in full swing) no less than 8,611. Since 1940 all British tanks have been fitted with welded wheels.

At the beginning of the war, the welding of armor was confined for the most part to plates up to 14 mm thick (0.545 in.), but at the present time armor plate up to 3 and 4 in. thick and even more is being welded.

The welding of armor plate was one of the most important developments of the war.

Fabricated Guns, Carriages

A number of guns such as the 25 pounder, 17 pounder, 3.7 A.A., Bofors, PIAT, Spigot mortar and the Sten gun were all subsequently manufactured by welding. Space does not allow a detailed description of the manufacture of these guns. For instance, the manufacture of carriages for the 40-mm quick-firing antiaircraft gun was constructed by welding, and considerable use of jigs was made for increased output.

Many features of interest attach to the carriage or traveling platform, a view of which is shown in Fig. 1. The all-welded platform is mounted on four pneumatic-tired wheels, which are not used when the gun is in operation. Then the platform is supported on four screw-operated jacks, and the wheels are removed by detaching the axles completely from the main frame. Four steel stakes are used to anchor the platform. When not in use these are housed on the sides of the main longitudinal frame member, two in each side, as the illustration shows. Interposed between the gun mounting and the platform is a turntable mounted on ball bearings.

In Fig. 2 the platform is resting on its four jacks, and the illustration also shows how the stakes are employed to anchor the equipment in position on the ground. Tubular members "A" are provided at either side for two of the jacks; these are detached and housed as shown in Fig. 1 when the gun is not in use. The main members of the platform are of welded box-form construction and joined together by welding. Welding is also used for attaching the various bracing members, gussets and brackets. Formerly, riveting was employed.

The production of the carriage and mounting for the 40-mm gun was entrusted by the Ministry of Supply to a number of private firms which supplement the production of the Royal Ordnance factories. One manufacturing firm concerned had peacetime products calling for frequent variations in design to meet individual requirements, and in consequence a large

British Official Photograph

Fig. 3—Field Marshall Montgomery watches Royal Engineers build a Bailey bridge from prefabricated components

measure of flexibility could be provided by its manufacturing facilities for production of gun mountings and traveling platforms.

Arc welding was also used in aircraft production, and most of the work for the manufacture of individual members and connections was done with the aid of welded jigs and fixtures, some of a very complicated nature.

Welding in the Field

The greatest amount of arc welding in the army was undertaken by R.E.M.E., both in mobile and static workshops. Most of the welding work consisted of repairs and maintenance to heavy and light artillery tanks, trucks and other mechanized vehicles. It is interesting to note that R.E.M.E. welding squads with portable welding plants were on the beaches of Normandy on the morning of D-Day. Their job was to repair damaged equipment and keep it in the fighting line.

As it was necessary to supply the forces in the field with portable arc welding, equipment firms concentrated to a certain extent on the production of such machines. Mobile army units used portable engine-driven sets up to 250 amp.

In order to supply the fighting forces and the armanent manufacturers with suitable welding material, it was necessary for the welding manufacturers to coöperate very closely with the various ministries, government departments and research associations concerned. Mobile welding equipment rendered invaluable service during the war. In 1944 the War Office recognized the importance and practicability of large-scale welding in the field by forming a sapper welding unit designated as No. 1 Welding Platoon, R.E. The activities of the welding unit in the B.L.A. were fully described by Capt. O. Lithgow, R.E., in the February, 1946, *Transactions of the Institute of Welding*. The arc welders used were all of the engine-driven d-c single-operator type, of British or American manufacture, mounted on a trailer or within a truck.

The Bailey Bridge

The performance of the famous bridges built to the design of Sir Donald Bailey has received well-deserved tributes. Some details of their fabrication should be of interest.

The Bailey bridge (Fig. 3) is a through-type road bridge, the girders of which are made up from panels, 10 ft long by 5 ft deep, coupled together in pairs by means of high-tensile steel panel pins. The roadway timbers are carried on steel stringers supported by transomes, which rest on bearing plates located on the bottom chord. Footwalks cantilevered on the outside of the girders provide a crossing for pedestrians without impeding vehicular traffic. Where bridges of greater span or load-carrying capacity are required, the girders are reinforced by placing additional panels over the top of the lower ones; bridges have been constructed with panels three tiers high, with three rows of panels in each tier.

The details of the bridge are so arranged that a crew of a hundred men can erect a 130-ft span, capable of carrying the heaviest tanks, in 1½ hours in daylight or 3 hours in the dark without lights. The only erection tackle required consists of two 15-ton jacks, some leather mallets and spanners and special chord-jacking levers for the two-tier and three-tier bridges.

Each panel is made of high-tensile (74,000–84,000 psi ultimate) steel sections having a yield point of 46,000 psi. Under extreme loading conditions, panels may be stressed as high as 38,000 psi The panels weigh 500 lb each and can be conveniently handled and stacked in standard 3-ton trucks so that no special transport vehicles are required.

When the development of the Bailey bridge reached its trial stage, the firm of Braithwaite and Co., Engineers, Ltd., was selected to provide the jigs and fabricate the prototype panels. The bridge was erected at the Experimental Bridging Establishment at Christchurch and given full-scale loading tests. Certain minor modifications suggested by the fabricators were adopted, and a complete bridge was ordered. The experience gained in the fabrication of these prototype models enabled the company to provide the Ministry of Supply with a complete set of manufacturing data, jig details and welding procedures, from which they were able to place indents on the many firms participating in the main production.

The plan required a period of only nine months from the date of its inception to the date of its

launching as a complete production scheme, which indicates a fine record of collaboration between the designers, steelmakers and fabricators. During the period from July, 1941, to August, 1945, over half a million panels were produced, which with their component parts (*i.e.*, stringers, transomes, ramps, etc.) called for nearly five million tons of steel. Of this amount, 60,000 panels requiring 17,500 tons of steel, together with 23,000 tons of components, were manufactured at the company's Newport and West Bromwich works, also engaged in the manufacture of armored fighting vehicles and other projects.

It is obvious that work of this nature, undertaken by many engineering firms throughout the country, must be so made that the components are completely interchangeable. A girder built up of panels linked together in the field under battle conditions must be a perfect fit, and the necessity for providing a structure of this nature with connections that can easily be assembled, dismantled and re-erected requires degrees of tolerance hitherto considered impracticable in structural engineering. This provided a major problem for the inspection authorities, who devised and had constructed a set of gauges for each parent firm in order to check the components as they were produced; these gauges were generally available to the firms by the time the first of their components were coming off the production lines.

During the peak period of production, the Braithwaite Newport works maintained a production schedule in excess of 400 panels per week, together with the concurrent program of transomes, stringers and other components. This required a carefully detailed program for planning and coördinating the large input of rolled steel coming from mills in Great Britain and the U.S.A. and the output from fifteen subcontractors making 42 components running into the order of 100,000 units per set.

Finally, as a point of interest to weldors, we would mention that 9½ million feet of electrodes, weighing 525 tons, were used in the output from Newport works. In order to keep pace with consumption, a stock of half a million feet, weighing 30 tons, had to be continually replenished. It was no unusual sight to see a couple of railway carloads of electrodes being shunted into the works instead of the usual dozen or so cases wheeled in on a hand truck, as is the more normal experience in most welding shops.

All-Welded Landing Craft

The Admiralty placed orders early in 1944 for the L.C.T. 8 type of landing craft with construction engineering firms in England, Scotland and Northern Ireland. The majority of these firms received contracts for ships which were mainly riveted, with small parts welded, but one firm in Scotland was requested by the Admiralty to proceed with the preparation of drawings and the fabrication of an all-welded design. It is the all-welded hulls of these ships that will be described.

The weight of structural steel in one ship was approximately 400 tons, and the shop preparation, assembly and production welding were carried through in 14 days; *i. e.*, 200 hours per week of shop output. There were 38 shop portions per hull, each about 8 tons, excluding deck houses and forward superstructures.

The dimensions of each portion were approximately 6½ by 14 by 20 ft.

All brass work was dispensed with in the deck house structure and non-magnetic plating and flats substituted. These were welded by austenitic rods. Generally flats were adopted for stiffeners in the deck house, but toe-on angles were used where strength was required.

The berth assembly and tack welding of the 38 shop portions which comprised one complete hull took ten days, excluding deck house, forecastle, bow and ramp doors. The berth assembly took a further 14 days for deck houses, coamings, forecastles, etc. During these assemblies, transverse penetration welds were proceeding and ordinary welding commenced. Berth assembly of bow and ramp doors took a further seven days.

Priority was given to berth welding in and around the engine and generator rooms and the hull forward of engine room to facilitate early installation of engines, generators, etc. Thereafter were completed the fitting and welding of small structural parts, deck machinery, hull and engine room plumbing, electrical installations, ventilating fittings, etc.

The total period on berth, from the placing of the first shop portion to date of launch, was 14 weeks. Fig. 4 shows one of these LCT's being launched.

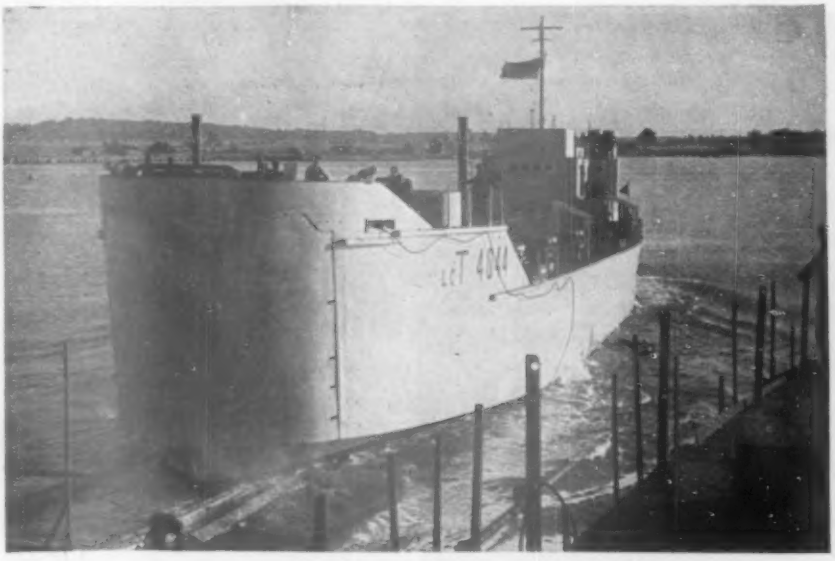


Fig. 4—An LCT 8 being launched. Unlike their American counterparts, most British landing craft were riveted, but there was one shipyard in Scotland which turned out all-welded hulls

Industrial Motor Line

★ DESIGN

BY QUENTIN GRAHAM
Manager, Ridgway, Pa., Div. of the Elliott Company

Fig. 1 (left)—New Elliott "Fabri-steel" squirrel-cage motor with ball bearings and splash-proof enclosure

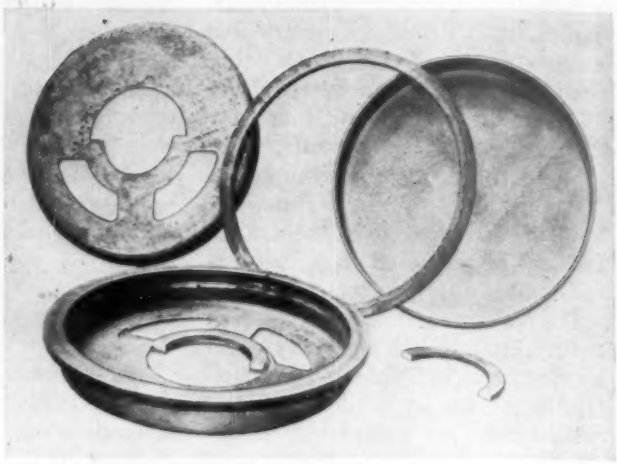


Fig. 3—The body of the bracket is cut from a flanged head, to which an edge-rolled ring is welded to form a bolting flange

DESIGNING and manufacturing engineers are continually finding new ways of applying welding to the manufacture of electric motors and generators. A recently developed line of moderate-sized welded steel squirrel-cage motors (Fig. 1) illustrates one such application. Motor sizes are from 150 to 1,000 hp, 4 poles, with corresponding ratings for other poles.

Some of the problems presented to the designer were:

1. Standard enclosures such as drip-proof, splash-proof, forced-ventilated, etc., must be available.
2. Both split-type sleeve bearings and ball or roller bearings are required.
3. A variety of core widths for each diameter, as well as special mounting dimensions, must be readily obtainable without excessive tool and fixture cost.
4. Appearance is important; clean lines and modern styling are desirable.

Separate Bearing Housing

A unique feature is the bearing bracket or end shield (Fig. 2). The bearing assembly is a separate insert, an arrangement that makes inspection and replacement of sleeve bearings relatively easy. Instead of having to unbolt and lift off a heavy half-bracket, the maintenance man simply removes a light bearing cap.

From the manufacturer's standpoint, machining becomes much simpler than for conventional split brackets. The small housing, the more intricate part of the structure, is handled on a turret lathe, a small milling machine and a drill press. The large-diameter piece, the bracket proper, requires only

Fig. 4—Stator under construction. Punchings are built on a mandrel, pressed between heavy end plates and secured by angles welded to and extending past the end plates. The angles are also welded to the frame side plates. A wrapper is later added

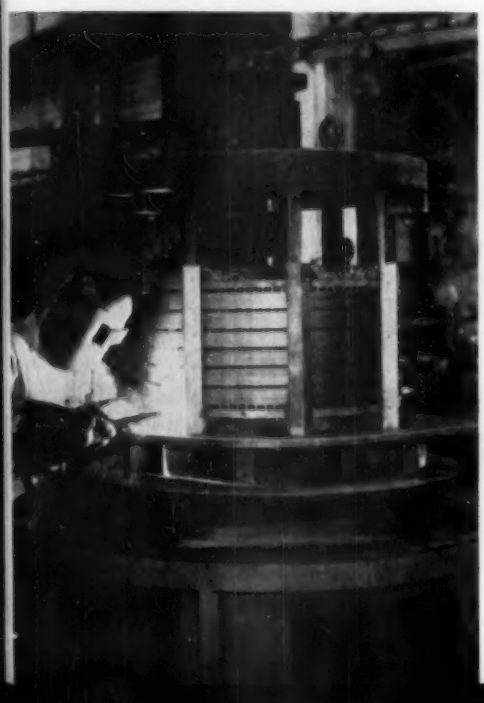
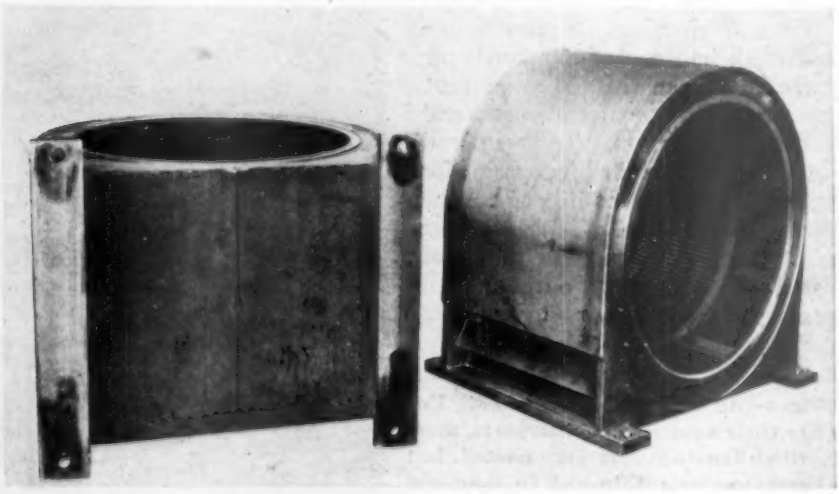


Fig. 5—Stator frame ready for winding. Baffle plates on the bottom of frame prevent recirculation of discharge air into the air intakes



Fabricated by Welding

Marking a new era in steel fabricated designs for large rotating apparatus, the new Elliott "Fabri-steel" electric motor line made its initial appearance at the Electrical Engineering Exposition in New York on January 27. Welding and flame-cutting simplify production.

Fig. 2—Rear of squirrel-cage motor, showing the bearing bracket. This construction allows easy access to the bearing sleeve without the necessity of removing a heavy half-bracket as required in conventional designs

two simple boring and facing operations plus some drilling and tapping in one plane. The elimination of the operations of milling the parting surfaces, turning the bearing seat and drilling and tapping holes at various angles in a large heavy structure is a decided manufacturing advantage.

The components of the bracket proper appear in Fig. 3. It starts as a flanged head, to which an edge-rolled ring is welded to form a bolting flange. Openings are flame-cut in the head as required for ventilation and for insertion of the bearing housing, and an additional bearing support is welded in place. The resulting structure is rigid but lightweight.

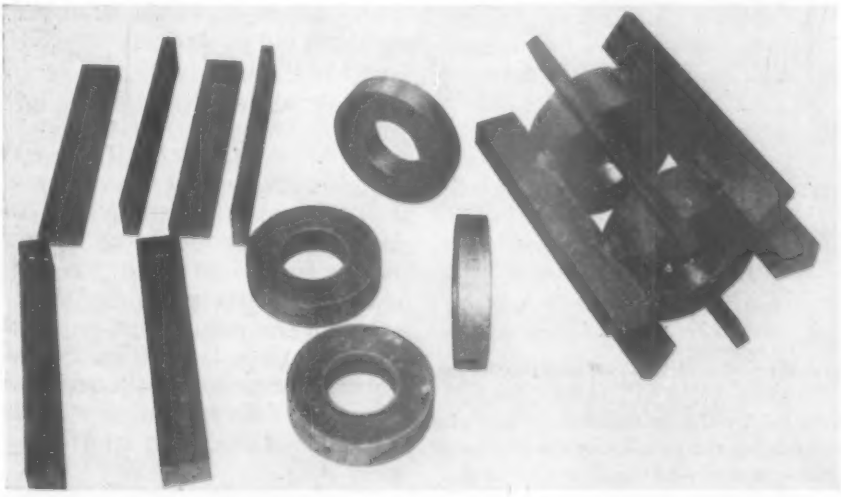
The stator member (Fig. 4) contains some novel features. Instead of the usual frame, a supporting structure is built around the punchings. A mandrel is first set up and the punchings are stacked over slot keys and pressed between end plates by hydraulic pressure. The cross members, consisting of steel angles, are then welded to the end plates to lock the core in place. At two or more points the weld is carried across the back of the punchings to act as a key against circumferential movement.

The frame plates are welded to the ends of the angles in such a position as to give proper ventilating space around the core. Feet are positioned in the building fixture, welded in place and a heavy wrapper plate is finally applied.

Modern flame-cutting technique is sufficiently accurate, it was found, to cut the core end-plates and frame plates from rolled plate stock without the need for any machining before assembly. To reduce scrap losses, the end plates are taken from the centers of the frame plates.

After the stator has been completely stacked and welded, it is stripped from the building fixture and placed on a similar but somewhat simpler fixture for machining the bracket fits. This fixture has a pilot fit which engages the center of the boring mill table to insure accurate concentricity between the inner diameter of the stator punchings and the bracket fit. With the small air gaps required in squirrel-cage motors such attention to concentricity of parts is essential. Fig. 5 shows the welded stator frame when ready for winding.

Fig. 6—When a rotor spider is required, it is fabricated from flame-cut steel rings and bar stock. Copper components are added by brazing



Welded Rotor Spider

For certain sizes and speeds of motors, a fabricated steel spider is used. Fig. 6 shows how this is built up from simple flame-cut rings of heavy plate and lengths of bar stock. Rotor clamping plates are flame-cut and welded in place on the spider. The rotor bars and end rings are joined by phos-copper brazing rods.

The final result is a motor which can be adapted to the various requirements of the industrial field with a minimum of engineering and tooling changes. It has adequate enclosures, is lightweight but rigid, has the clean lines and smooth appearance characteristic of modern machinery design.

Metallizing of

Fig. 1—A worn booster ball as taken out of service to be built up by metallizing

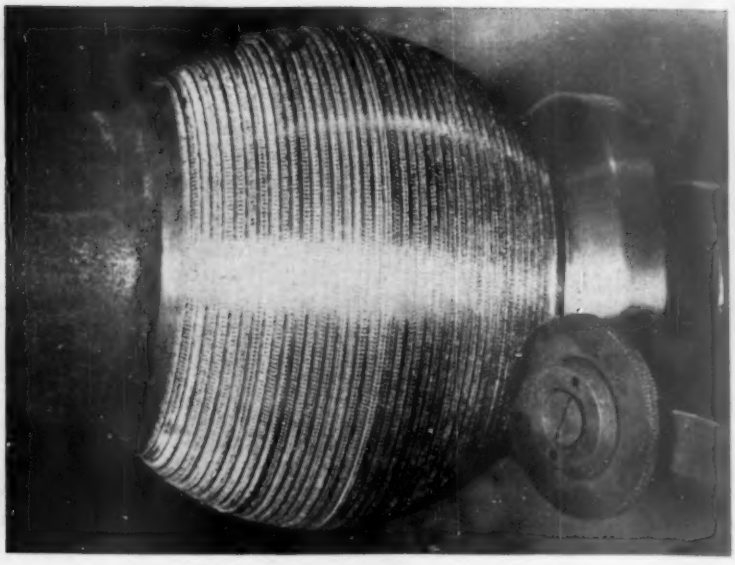


Fig. 3—Applying the knurling tool to the previously grooved surface. The ball is now ready to receive the sprayed metal (Fig. 4)

Metallizing of cylindrical surfaces is commonplace, but the metallizing of a spheroid—well, that is really something out of the ordinary. Mr. Christopher explains the interesting technique developed by the "Soo Line" to return battered booster balls to service.

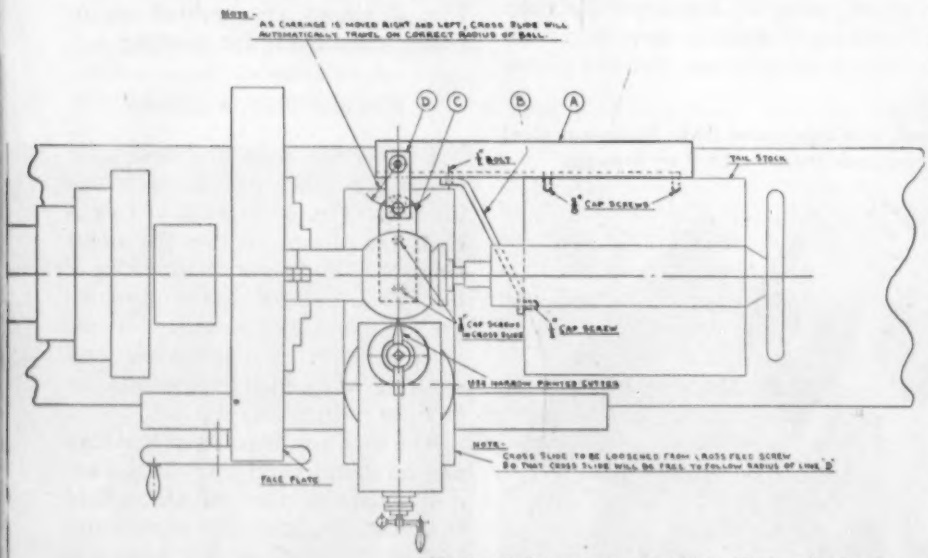
BY C. B. CHRISTOPHER

Shoreham Shops, Minneapolis, St. Paul & Sault Ste. Marie Railroad

MANY of our locomotives require six booster balls: three on the right side acting as flexible joints on the exhaust steam line and three on the left side acting as flexible joints on the steam lines to the booster engines. Originally, these balls were made of bronze and wore fairly well. During the war, however, the manufacturer was compelled to use cast steel, which meant frequent replacements because of erosion and corrosion. Fig. 1 shows one of the worn balls as taken out of service.

Lathe Attachment Designed

It occurred to us that if we could satisfactorily surface the cast-steel ball with stainless steel, an even better product than the prewar bronze ball might result. We decided to use our metallizing equipment for this purpose and arranged a device on a lathe (Fig. 2) that permits the contour of the ball to be accurately followed during preparation, metal spraying and finish machining.


NOTE:-
AS CARRIAGE IS MOVED RIGHT AND LEFT, CROSS SLIDE WILL AUTOMATICALLY TRAVEL ON CORRECT RADIUS OF BALL.
D
C
B
A
BOLT
TAIL STOCK
CAP SCREWS
CAP SCREWS
CAP SCREW
USE NARROW PARTED CUTTER
NOTE:-
CROSS SLIDE TO BE LOOSENED FROM CROSS FEED SCREW SO THAT CROSS SLIDE WILL BE FREE TO FOLLOW RADIUS OF LINE 'B'
FACE PLATE

Sketch and photos courtesy Metallizing Engineering Co., Inc.

Fig. 2—Plan of the lathe attachment designed by the railroad to permit the spherical contour of the ball to be followed during the successive operations of undercutting, grooving, knurling, metal spraying and finish machining

Spherical Surfaces

★ MAINTENANCE

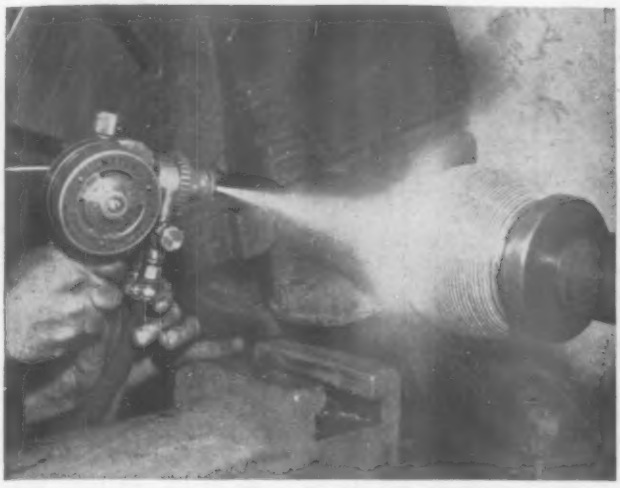


Fig. 4—A stainless-steel coating is sprayed over the spherical surface to a thickness approximating 0.160 in. on the radius. This allows for finish machining

Fig. 5—Three balls after finish machining. Protected against wear and corrosion, they are now ready to go back into service on locomotives of the "Soo Line"

A word or two of explanation may be in order for those who are not familiar with production metallizing techniques. If the work is cylindrical and can be swung in a lathe or mounted on a boring mill, it is common practice to perform all of the necessary operations as near mechanically as possible. It is highly desirable that the surface be prepared, the metal applied and the finishing done in one lathe set-up—a procedure that both simplifies operation and drastically reduces costs.

As is explained by the sketch, our lathe arrangement allows the cross slide to be loosened from the cross feed screw so that the slide will be free to follow the radius of link "D" (Fig. 2). Then the cross slide will automatically travel on the correct radius of the ball as the carriage is moved right and left.

Our present practice is to take a booster ball out of service when it has been worn down to a diameter of $6\frac{13}{16}$-in. The ball is then set up in the lathe and undercut to allow for the coating of stainless steel that will be added. In estimating the thickness of sprayed metal to be applied, it was necessary to take into account the amount to be removed in finish machining as well as the amount of wear to which the ball is to be subjected. Once specifications were established, however, they can be followed for every ball.

Preparation Technique

The next step is to prepare the ball to receive the sprayed metal; for this we use the standard procedure developed for cylindrical metallizing. Preparation is in two stages: grooving and knurling. Grooving is done with a specially ground cutting tool having a rounded bit; its object is to provide a continuous spiral of roughly cut grooves with which particles of sprayed metal can interlock in a strong mechanical bond. A knurling wheel (Fig. 3) is then mounted on the tool post and run back and forth to spread the ridges and thus form dovetail grooves. Knurling also roughens the tops of the ridges and so provides further interlocking of the sprayed metal particles.

Grooved and knurled, the ball is now ready for the application of the sprayed molten stainless-steel coating. As shown in Fig. 4, the operator holds the metallizing gun in his hand while the ball is rotated in the lathe. It would, of course, be possible to devise a means of holding the gun mechanically, but this was not deemed necessary in view of the comparatively small number of balls to be resurfaced.

Spraying continues until a coating approximately 0.160 in. thick has been added, bringing the diameter of the ball up to $7\frac{1}{8}$ in. This is ample allowance for finish machining to the specified final diameter of $7\frac{1}{64}$ in. The appearance of the stainless-clad booster balls after finish machining is shown by Fig. 5; compare this picture with the worn ball in Fig. 1.

Three Hours per Ball

The approximate time required to perform all operations and completely finish a ball is three hours. The time element is considered to be well in line, in view of the fact that this is a maintenance and not a production metallizing job. About six pounds of stainless-steel wire are applied to each ball.

An excellent finish is obtained by using "Rexalloy" tool bits, and perfect contour is easily held with the special lathe attachment previously mentioned. The first balls that we sprayed by this method, on May 5, 1945, are still in service with no indications of wear.

Here's Why

MORE and MORE and MORE

FIRMS ARE TURNING TO A. C. WELDING...with G-R EQUIPMENT

1. Because they're saving money. Power-factor corrected G-R's cost less to install, and show savings of 15% to 25% in power costs as compared to d. c. welders of similar output.

2. Because they're getting increased production. Magnetic blow is absent in G-R's smooth a. c. arc; you can use higher heat with faster burn-off. That means higher rate of deposit... *more welding done every hour.*

3. Because they're getting better results. G-R's smooth a. c. arc is easily handled in *all* positions; with no magnetic blow, there's less spoilage from cratering, no undercutting; welders quickly learn to make uniformly high-quality welds at high speeds ...you get a *better* job, done faster, at lower cost!

Step up production with A. C. welding... and for A. C. at it's best, specify **G-R!**

G-R Model 35, with a welding range of 15 to 330 amperes, heads the G-R line of five "General Purpose" welder models, starting with the 15-140 ampere Model 15C. All are available with built-in power-factor correction.

The 10- to 675-ampere Model 49 is one of four G-R Heavy-Duty Industrial Models for manual operation. G-R also builds heavy-duty models for automatic-head welding, to 2,500 amperes.

GLENN-ROBERTS COMPANY

2107 ADAMS STREET • INDIANAPOLIS 1, INDIANA
3100 E. TENTH STREET • OAKLAND 1, CALIFORNIA

NASH BUILDS WELDED BODIES

(Continued from page 41)

of points where the lower part of the front wheel house panel meets the extended floor side sill panel and the front cross member.

From the snake line the bodies are transported to another section of the fifth floor where the exposed joints between the roof and unisides and between the cowl top and cowl side panel are filed flush. Small openings left between the tack welds are filled with solder.

Doors and Trunk Cover

Doors and trunk cover, the next parts to be added, are fed into the main assembly lines by means of an elevating conveyor from another part of the plant. These parts are constructed entirely of steel stampings. The inner and outer door panels are spot welded together at the flanges as shown in Fig. 5. The outer edges of both doors and trunk cover are spot welded with a back-up bar in order to avoid having a visible weld appear on the finished surfaces.

Such parts as the hand brake assembly, "Weather Eye" hopper assembly, "Weather Eye" heater unit mounting bracket and radio support bracket are now attached to the dash assembly and cowl side panel. When this work has been done, the body contains 7,135 spot welds and 335 arc welds.

The metal is given its final grinding and polishing and then "Bonderized" to protect it against the elements. After Bonderizing, the body is painted, trimmed and upholstered. One of the last steps of all is to insert the instruments on the dashboard panel.

The completed bodies are shipped to the company's Kenosha plant, where motive power and wheels are supplied. On the "600" model, engine, axles and wheels are added separately, while the "Ambassador" body is mounted on a chassis containing these parts.

Nash-Kelvinator is producing 548 cars a day in two working shifts and has turned out more than 100,000 of these welded vehicles in the past year. Yet the demand is still materially ahead of the supply.

ABOVE: Light weight permits easy movement to any location. No electric power connection required.

NEW CIRCLE CUTTER

. . . Features Spring Drive, Hydraulic Speed Control, Light Weight, Low Cost and Cuts Straight or Beveled Circles

The new Ohmstede Circle Cutter has a hydraulically controlled spring drive that eliminates need for power connections. It weighs only 90 pounds, costs only $275, and cuts either straight or beveled circles of any diameter up to 40″ from stock of any thickness up to twelve inches. Satisfied users say that it is *by far* the most useful circle cutter yet. Order one from your welding supply house or ask us for more information.

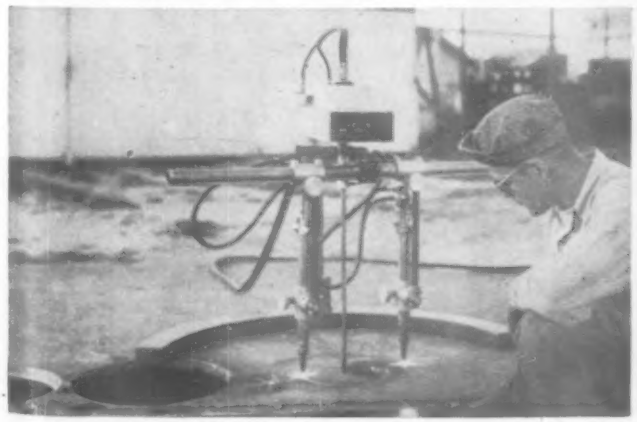
OMW

OHMSTEDE MACHINE WORKS

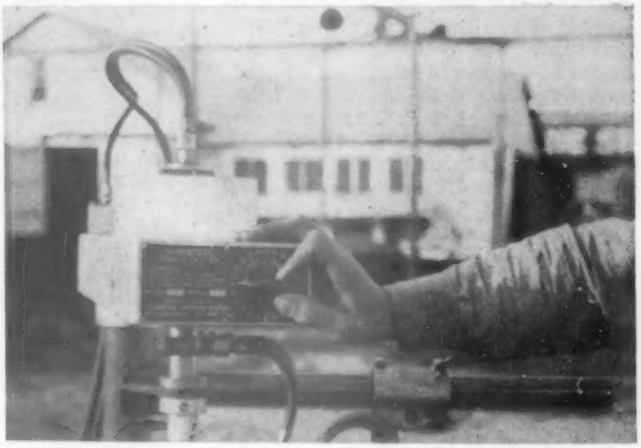
P. O. BOX 1288 **BEAUMONT, TEXAS**

BELOW, RIGHT: Machine will cut near edge of plate to reduce waste. Notice convenient centering rod.

BELOW: Two torches may be used to cut both diameters of ring simultaneously if desired.

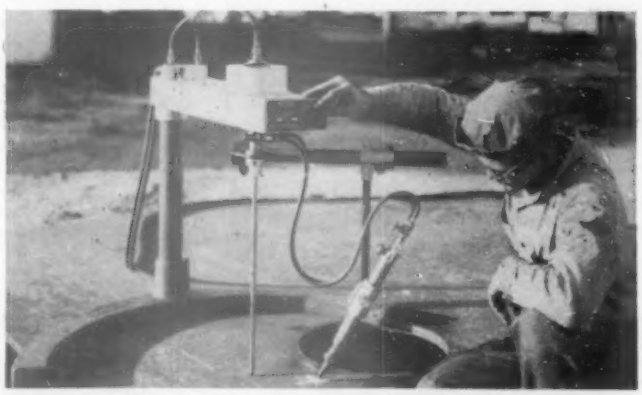


ABOVE: To wind, simply turn arm anti-clockwise to the stop. Indicator on top shows when spring is wound.



ABOVE: Regulate cutting speed by turning this knob. Speed is continuously variable from zero to highest useful speed.

BELOW: Torch is tilted for bevelled circle. Any diameter circle from 0″ to 40″ can be cut.



Short Cuts and Kinks

Welded Jack Posts

AMONG the many uses of welded steel tubing is the manufacture of an easily adjustable steel prop commonly known as a "jack post." Each post consists of two tubes, one fitting inside the other. The post can be thus extended to the desired height and retained there by passing steel pins through holes in each tube. A jack attachment on one end allows for fine adjustments. The posts are of two general types: the standard size which can be extended to eight or nine feet and a short type reaching a height of about one and a half ft.

When buildings begin to get out of alignment and floors start to sag as a result of seasonal changes in foundation, dry rot or termites, jack posts can be placed in the cellar to give added support at strategic points. These telescoping posts are also used in the construction of new houses. In factories they may be used to reinforce the area of a floor on which a particularly heavy piece of machinery, such as a press, is to be placed.

The Babcock & Wilcox Tube Co., Alliance, O., which furnishes the welded tubing for many of these posts, has already provided manufacturers with enough tubing to make approximately a quarter of a million jack posts.

* *

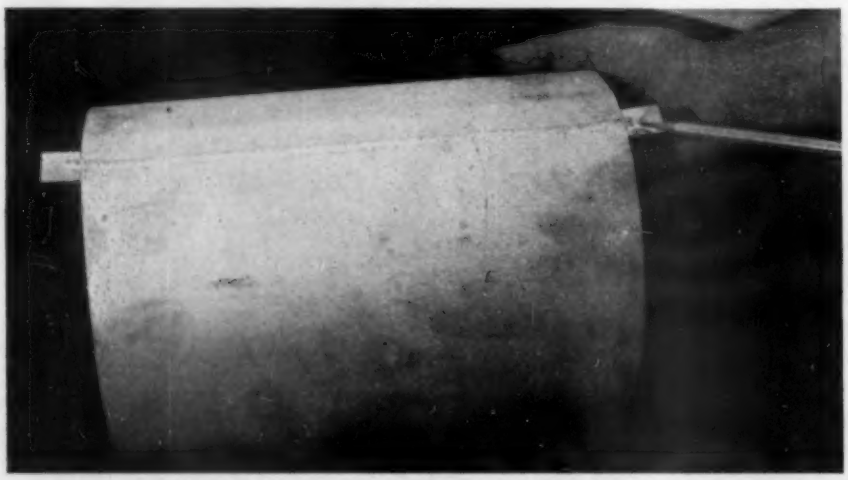
Metal Tabs for Arc Welds

By William P. Brotherton

IN ORDER to fabricate large cylindrical sections of stainless steel, the Ryan Aeronautical Co., San Diego, Calif., forms the flat sheets and welds the longitudinal seams by the metal-arc method. It was found that a defect, in the form of a notch, was usually produced at the beginning and the end of each seam.

The reason is not difficult to state. As the arc approaches an edge, the weld zone increases in temperature because of the decreased volume of surrounding metal to carry the heat away. The temperature rise causes a small amount of metal to melt and leave a notch at the edge of the seam. The part will usually split at this point when it is bent.

A Ryan employee, H. A. Faris, solved the troublesome problem by simply tack welding a small metal tab at each end of the proposed seam (see picture). The notches are thus moved over to the tabs, which are later trimmed off with a saw or nibbler.



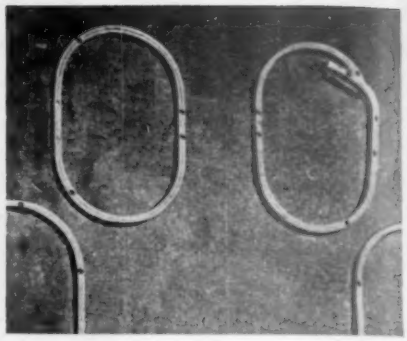
Small metal tabs mean more perfectly arc-welded seams in large stainless-steel cylinders

Any ideas for this section? Send them to THE WELDING ENGINEER, 520 N. Michigan Ave., Chicago 11. Payment made at our usual rates.

* *

Novel Templates

A REMOVABLE lead-in template is often helpful in starting cuts in the scrap area of the plate. An example is shown in Fig. 1 for a job calling for the cutting of two holes in a rectangular plate. The torch is started on the scrap to be cut out for the hole and directed automatically to the proper outline. Once the tracing unit has run onto the template, the lead-in section is removed and made ready for the second hole.

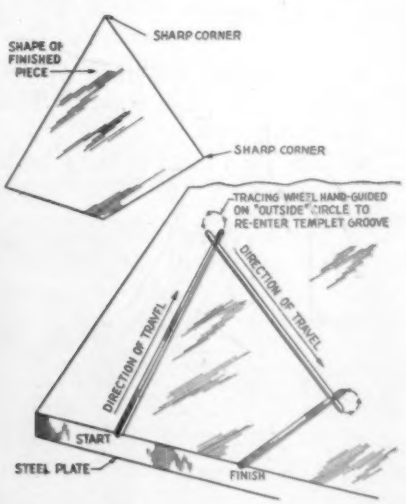


Courtesy The Linde Air Products Co.

Fig. 1—A removable lead-in template made from standard aluminum template strip in position for the right-hand hole

Two short pieces of aluminum template strip are used for the removable section. One piece is bent so as to guide the tracing unit in a sharp turn onto the top of the main template, and the other small piece is riveted to the top piece in order to support it on the template base. The entire section is held in position by two pins, which engage two small holes on the straight side of the template. The holes for receiving the pins can be seen in the template pictured at the left.

Another idea for simplifying the cutting of sharp corners is shown in the drawing, Fig. 2. A template was prepared by machining ⅛-in. vee grooves in a piece of 1-in. steel plate, extending them a short distance past each corner. The tracer wheel followed these grooves. On reaching the end of a groove, the wheel was hand guided in a small circle to the beginning of the next groove. It thus intersected the previous line of travel in a clean, sharp angle. As many as twenty ¼-in. plates stacked together were successfully cut at one time with this template.



Courtesy The Linde Air Products Co.

Fig. 2—Vee grooves machined in steel plate make an efficient template for flame-cutting sharp or square corners

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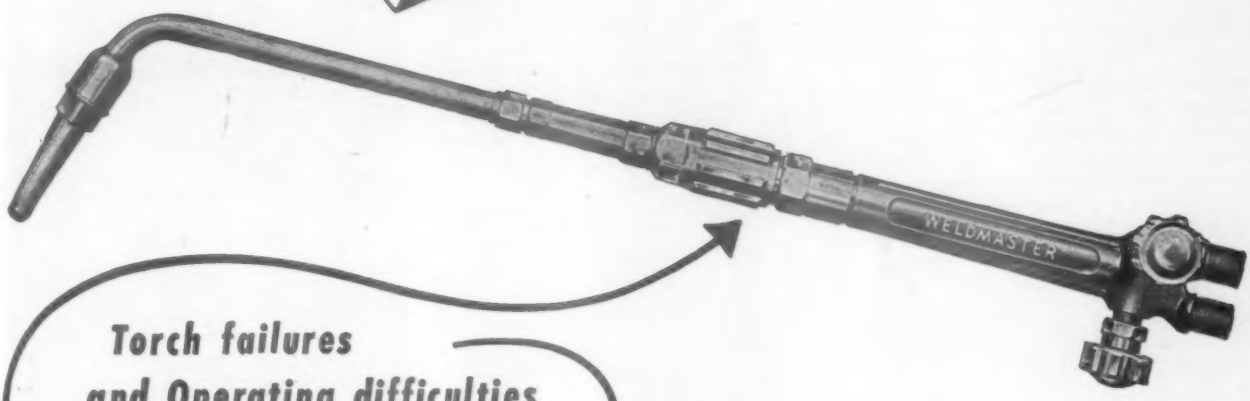

Torch failures and Operating difficulties usually begin at this point

Most Combination and Welding Torches make up on 'metal to metal' joints, and, naturally, over a period of regular use, this joint fails because of 'galling', the accumulation of dust particles and just ordinary wear, BUT, with a MECO Torch, this mechanical failure is easily overcome . . . that's because we use patented *armored* Gaskets which facilitate QUICK replacement *right on the job,* thus saving 'down time' for factory repairs.

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On the Job

X-Raying an Atom Smasher

ROPED together for their hazardous task, the two men shown in the composite picture below are preparing to X-ray the welded seams of the 65-ft-tall electrostatic generator at the Westinghouse Research Laboratories. In the larger photo, Dr. Fitz-Hugh Marshall, Westinghouse research engineer, and technician Floyd Craig are setting up the 140,000-volt "camera" for one of the X-ray shots which reveal the true condition of the welded seams in the huge outer tank. The close-up view shows Dr. Marshall aiming the X-ray tube at the seam while, inside the tank, the strip of film is being placed in position for exposure. A 30-second exposure provides a picture that will show up any flaw in the tank's welded seams.

Following completion of its X-ray check-up, the atom smasher will be put back in operation, exerting its strength of 4,000,000 volts to hurl electrified particles at speeds approaching 100,000,000 miles an hour.

As nonchalant as veteran mountain climbers, these two research men are X-raying the welded seams of a giant atom smasher used for work in nuclear physics

* *

A Job with Teeth

TWO-TONE welding made it possible for Griff's Welding Shop, Coatesville, Pa., to rebuild a 10-ft sand drier gear having 104 badly worn teeth. The gear is made of cast steel, weighs about 3,300 lb and measures 10 in. across its face. It had been run in both directions, wearing the teeth to a knife edge on both sides. This made it difficult to determine the tooth centers. Fig. 1 (bottom of page) shows the extent to which the teeth had been worn down.

It was decided to build up the abraded teeth by the "two-tone" process, a method of welding in which a mild-steel electrode is applied simultaneously with a hard-facing or other special type of filler rod. About 700 lb of 3/16-in. and 1/4-in. E-6012 (all-position) electrodes were used with cast-iron core rods to restore the teeth to their former serviceability.

Fig. 2 shows the teeth as built up by two-tone welding. The welds were so smooth as-deposited that very little grinding was necessary. The gear was back in operation after a delay of less than two weeks, involving 237 man-hours of welding.

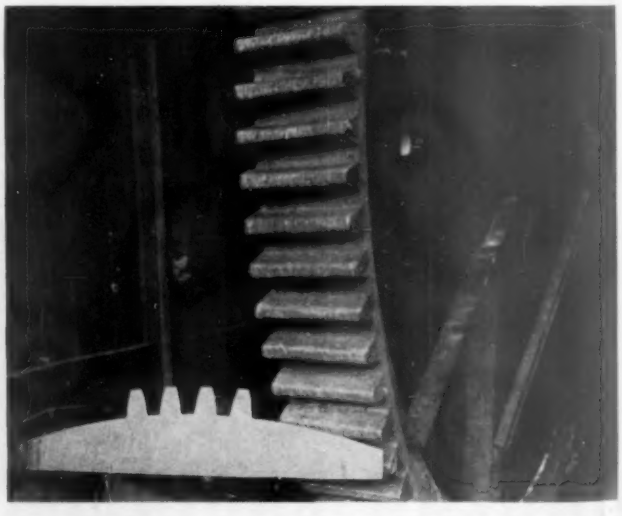
* *

The butt ends of this 66-ft strip of stainless-steel sheet were flash welded to form an endless polishing belt for tires

Flash-Welded Belt

AN ENDLESS belt 66 ft long by 24 in. wide was needed by a tire manufacturer for the polishing of the plastic compound that is used for white-walled rims. American Welding & Manufacturing Co., Warren, O., was given the job of fabricating such a belt from a strip of type 301 stainless steel, 0.035 in. thick. The butt ends were aligned to within a half-thousandth of an inch and flash welded together on a 250-kva automatic welder.

Fig. 1—Section of a 10-ft cast-steel sand drier gear showing the great extent to which the 10-in. teeth had been worn down



Photos courtesy General Electric Co.

Fig. 2—View of the teeth on the same gear after they had been rebuilt with two-tone welding. Note smoothness of weld metal

Seam Welding Sheets under Gauge Thickness

PERFECT seam welds in a sheet of type 302 stainless steel of 0.0015 in. thickness—about the thickness of a sheet of paper—were made by the Solar Air-

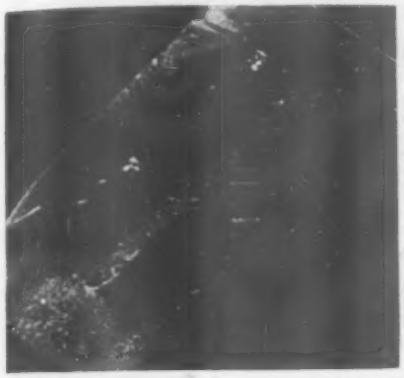


Fig. 1—Macrograph taken at 4X of a seam weld in 0.0015-in. stainless-steel sheet

craft Co., San Diego, Calif., in connection with the fabrication of insulation blankets for a late turbojet engine.

The macrophotograph, Fig. 1, depicts a seam-welded sample that has been partially subjected to the peel test. The apex of the tear is well rounded and the full width of the nugget, indicating complete fusion and a full-strength weld.

The microphotograph, Fig. 2, is of a

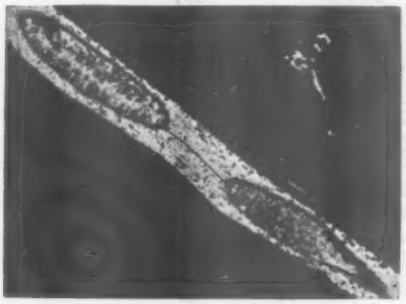


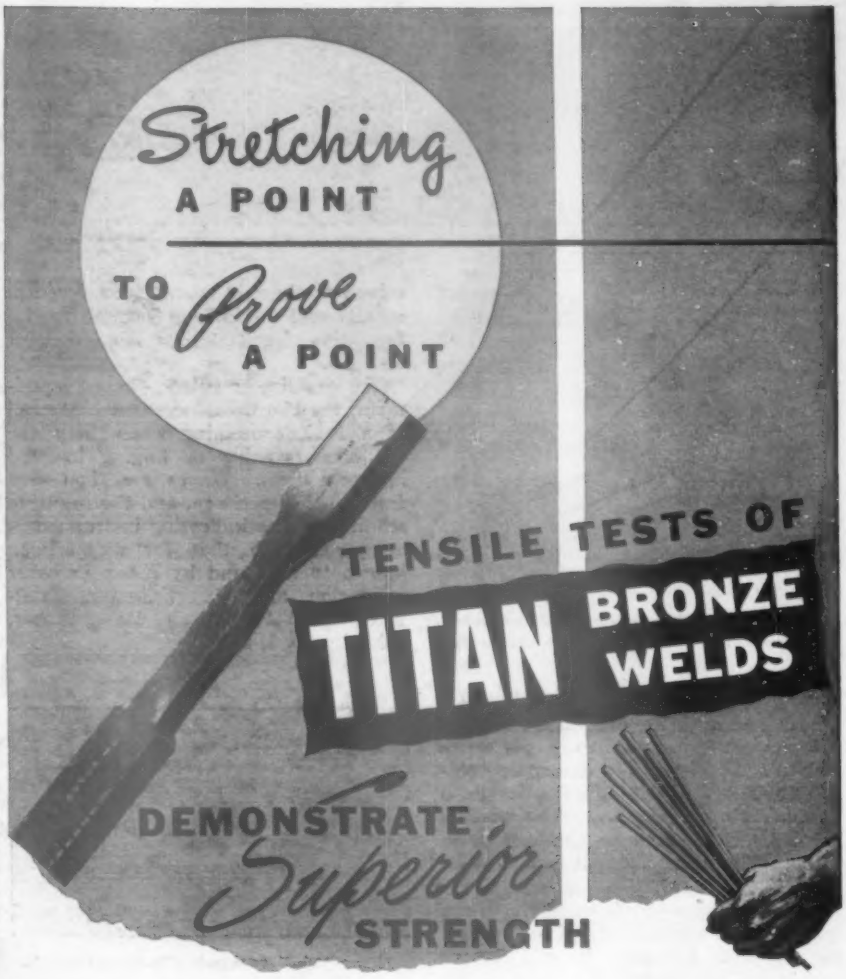
Fig. 2—Micrograph taken at 150X of a seam weld at twice the speed of Fig. 1

seam weld made with a doubled welding speed in order to expose individual nuggets for inspection. The diameter of the nugget shown is 0.011 in. along the major axis and 0.0023 in. on the minor axis. Weld penetration is approximately 72%. No evidence of voids, cracks, inclusions or abnormal structures was found in these samples.

The superthin sheet of stainless was prepared by cleaning it free from grease or other foreign matter, including fingerprints. It was then welded under the following conditions:

Electrode force, 120 lb; time, one cycle on and one cycle off; current, approximately 4,000 amp; electrodes, RWMA Class 1, 8-in. diameter, 3/16-in. wide, 1½-in. radius face; speed, 18 in. per minute (for gas tight welds; spots per in., 100 (for gastight welds).

Light burnishing with a No. 400 emery paper is recommended.



The tensile test specimen illustrated above was made of 0.2 carbon steel with a vee weld of TITAN'S Penn Bronze in the center. Note the steel has "necked down" (where it later broke) but that the bronze weld is undamaged.

Numerous tests such as this one have proved the unmatched soundness, strength and ductility of welds made with TITAN Bronze Welding Rods. Titan's exclusive double deoxidation process protects against the formation of gases and harmful oxides in bronze welding . . . thus assuring non-porous welds of greater strength and higher ductility. Specify Titan Bronze Welding Rods for your next welding job.

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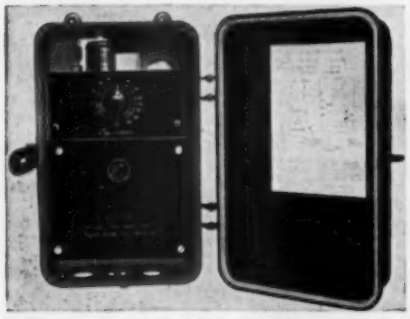
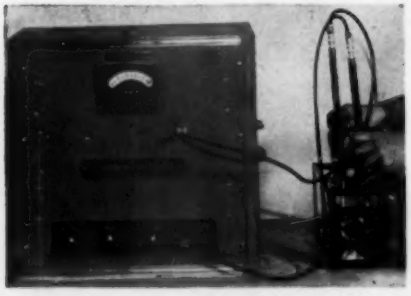


Electronic welding timer for all-purpose spot welders over a range of 3 to 120 cycles

Weld Timer

RECOMMENDED for all general-purpose welders for operations over a range of 3 to 120 cycles, a new electronic welding timer (type 30CR3) is applicable to manual, air or motor-operated welders requiring either beat or non-beat operation. Timing adjustment is located on the panel inside the housing, which permits a tamper-proof setting. Timer may be used with either 115 or 230 volt a-c supply. Accuracy is said to be within 2% throughout the range of the unit, which fulfills all NEMA specifications. PHOTOSWITCH, INC., 77 Broadway, Cambridge 42, Mass.

* *



Ultrasonic materials tester indicates cracks and porosity in metal castings, etc.

Supersonic Tester

BY sending a beam of supersonic waves through a metal part, this new "ultrasonic" materials tester indicates presence of voids, cracks, porosity, laminations, poor bonds and other internal flaws. Changes in the amount of energy transmitted through the part are an indication of the presence and extent of flaws.

Portable and self-contained, the testing unit consists of a wide-band transmitting-receiving system having a high-frequency generator, a crystal transducer for producing ultrasonic vibrations, a medium to transmit these vibrations, a second crystal transducer to convert the received mechanical energy into electrical signals and an indicator supplying information for materials inspection or analysis.

To examine regularly-shaped specimens, the two transducers are immersed in a tank containing water with the weldment, casting or forging inserted between them. Waves are then sent through the specimen, and the resulting reading on the indicating instrument is compared with that for a specimen known to be sound by X-ray or other inspection methods. GENERAL ELECTRIC CO., APPARATUS DEPARTMENT, Schenectady 5, N.Y.

* *

"Flux-Stik," a soldering flux molded into stick form, gives clean and perfect joints

Soldering Flux

"HANDY as a pencil," claim the makers of a new soldering flux in stick form. "Flux-Stik" can be used for overhead, inaccessible and out-of-the way soldering locations, for sweat joints of copper or brass tubing, manifolds, traps, elbows, piping, sheet metal, etc. It is non-acid and is said to thoroughly dissolve the oxides of metals and prepare a clean surface for the solder to alloy itself with the metal. When heat is applied, the flux covers only the immediate vicinity of the soldering joint. It can be applied equally well to either hot or cold metal. LAKE CHEMICAL CO., 607 N. Western Ave., Chicago 12.

* *

Cut-Off Wheel

DESIGNED to cut all materials from steel to stone, the new "Ripper" abrasive cut-off wheel is said to cut cooler, faster and last longer. Sides of the wheel are made with radial depressions 0.006 to 0.008 in. deep, extending from the flange area to the edge of the wheel. Minimum thickness of wheel is $\frac{1}{16}$ in. in 6 in., $\frac{3}{32}$ in. in 8, 10 and 12 in. sizes. Manufacturer states that field tests show the ripper wheel gives good performance on both portable and cut-off machines. AMERICAN EMERY WHEEL WORKS, Richmond Square, Providence 1, R. I.

Gleason's semi-pneumatic industrial wheel

Industrial Wheel

AN all-purpose 10 by 2.75 semi-pneumatic-tired wheel has been built for the heavy-duty transportation requirements of factories, shipping rooms, warehouses and farms. It is constructed of heavy-gauge steel and fitted with Jumbo balloon tires and hardened roller bearings. GLEASON CORP., Milwaukee 3.

* *

Quick-Action Clamps

"WESPO" adjustable work-holding clamps are of the quick-action type. Stud washers with ground spherical radii allow the clamp to float and so compensate for irregularities in the work. Made of heat-treated alloy steel, cadmium plated, the clamps are available in five types and six sizes. Exact scale template drawings are provided for each type and size, so that fixture designers can include the clamps in their layouts. WEST POINT MFG. CO., 19643 Merriam Court, Farmington, Mich.

* *

Nickel-Clad Strip

DEVELOPMENT of steel strip clad with rolled nickel or Monel is announced by SUPERIOR STEEL CORP., Carnegie, Pa. This composite strip can be spot welded, stamped, drawn, spun, bent or otherwise fabricated in the same manner as low carbon, deep-drawn steel. It is available in widths between $\frac{1}{4}$ and $10\frac{1}{4}$ in. in coils ranging up to several hundred feet, depending upon the gauge. In the cold-rolled condition, the strip is produced in thicknesses between 0.010 and .125 in. In the hot-rolled condition, it is available in thicknesses between 0.095 and $\frac{1}{4}$ in. Depending on requirements, the clad strip is furnished with cladding on one side only or on both sides. It is impossible to separate the nickel or Monel cladding from the steel base by any other means than the chemical dissolving out of the steel from the cladding, manufacturer claims.

Higher Amperage - Cooler Operation

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The heavy duty Rod Saver – 400-500 amp. – operates with 5/16" electrodes under sustained welding conditions. Weighs only 19 oz., is 10½" long.

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The general purpose Rod Saver for all operations where a capacity through 300 amps is desired. Stubby handles electrodes to ¼", is 8¾" long and weighs only 16 oz.

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Standard or special polished, clean and black. Seven standard diameters, 12-inch lengths. Random lengths and unusual diameters available on special order.

TWENTY-SEVEN YEARS OF PIONEERING IN TUNGSTEN METALLURGY

Cutting Attachment

BUILT for the "Oxweld CM-16" portable cutting machine, the new "under-the-motor" circle-cutting attachment makes it possible to flame-cut circles from 2½ to 9 in. radius on the extreme edge or in the corner of the plate. Radius of the circle to be cut is regulated by means of an adjusting screw. Circles above 9 in. in radius can be cut to the extreme edge of a plate without the attachment. LINDE AIR PRODUCTS CO., 30 E. 42nd St., New York City 17.

* *

Spot Welders

AVAILABLE with 12, 14 or 30 in. throat depths and 20, 30 or 40 kva transformer capacity, the new Thomson series "R" provides a wide choice of rocker-arm spot welders to suit both shops doing all-purpose spot welding and plants requiring special-duty welders for assembly-line production. Among the new features designed to improve performance is a tubular secondary transformer with non-corroding, non-clogging secondary sections and hard-rolled primary windings. The 8-point heat regulator has a star locking wheel to prevent drifting and assure efficient contact. All wiring on air or motor operated machines is centralized on an indexed terminal block to facilitate inspection and maintenance. Electrodes and transformers are water cooled from separate circuits with individual flow control and visual water drain. THOMSON ELECTRIC WELDER CO., 161 Pleasant St., Lynn, Mass.

* *

Electrode Holder

"CONTINENTAL" is the name of a 300-amp, fully insulated electrode holder featured by adjustable contact tension in the jaws for light and heavy electrodes. It requires only three seconds to loosen the Allen setscrew and turn the handle for the tension desired and retighten; only five seconds to remove handle and take the holder apart for cleaning or repairs. WELDING ENGINEERING CO., 264 E. Ogden Ave., Milwaukee 2.

* *

Hole Locater

BY means of the Knu-Vise hole locator, several sheets of metal can be quickly aligned to position them for welding or drilling. This device, which looks like ordinary pliers, has a toggle-action which automatically locks upon the work held, leaving the operator's hands free to perform other work. Pressure spindle can be adjusted to admit work up to 1¼ in. thick, and locating pins are available in all popular diameters. This 22-oz unit is 8 in. long, 3 in. wide and capable of holding a maximum of 500 lb. KNU-VISE, INC., 2207 Eighth St., Detroit 16.

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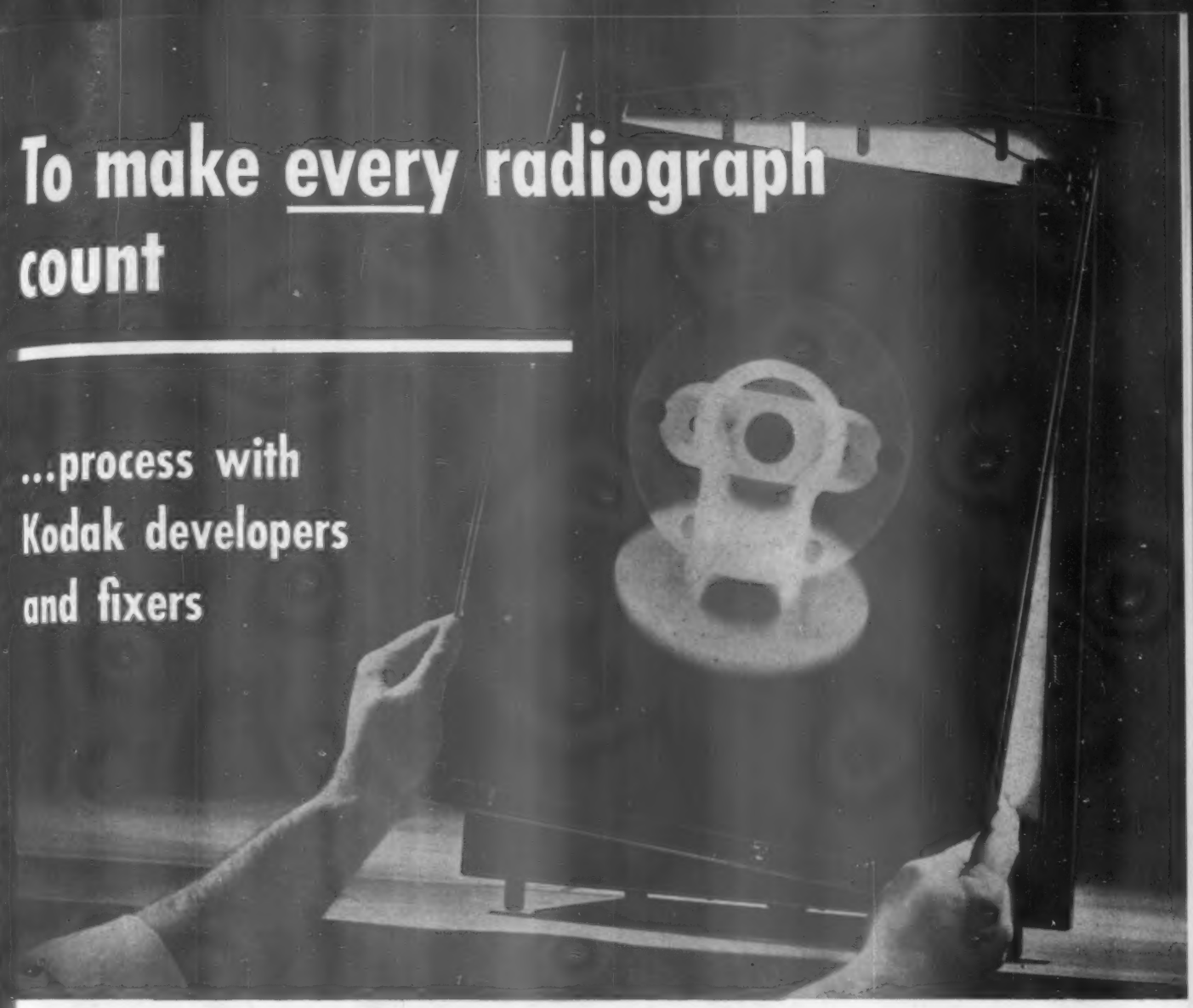

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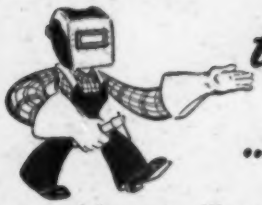

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Model 262 C has Built-In Capacitor for High Power Factor. Telnic Bronze plugs and sockets double current carrying capacity. Special transformer design delivers "Instant Arc Striking" without extra high frequency or booster gadgets. Wide welding range of 20 to 275 amperes. Fully Equipped. Models: 262 and 262 C (with Capacitor) 20–275 amps., 261 and 261 C (with Capacitor) 20–200 amps. 8 additional models from 125 to 400 amps.

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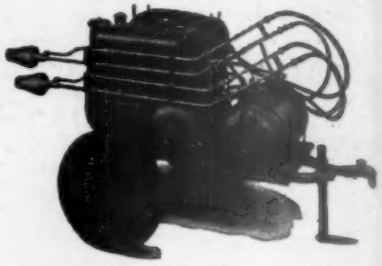
MINNEAPOLIS 14, MINN.

Power-Driven Heating Unit

OPERATING on compressed air and fuel oil, this portable two-torch heating unit has many applications in agriculture, highway construction, railroads, shipyards, etc. It produces high-temperature flames for such purposes as straightening, bending, shrinking and expanding metal parts or preheating broken castings to be repaired by welding. The engine drives the air compressor, which is manufactured by Schramm to work in conjunction with Aeroil tank and heater equipment.



Heating unit for straightening and bending metal parts prior to welding

Torches operate on kerosene or on any oil up to a No. 3 fuel oil. Air and fuel valves may be regulated to produce flames ranging in length from six inches to 15 feet long and varying in temperatures up to 2,000 F. When necessary, this machine can be used to run small air tools, or a pressure tank and spray bar can be added for the spraying of emulsions and concrete curing materials. AEROIL PRODUCTS Co., 5701 Park Ave., West New York, N.J.

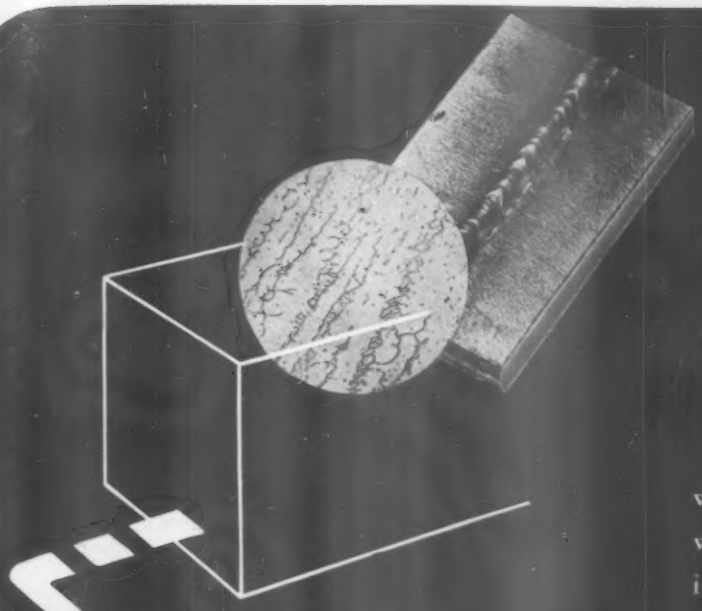
* *

Electrode for Cast Iron

A NEW Page electrode called "Ni-Cast" has been developed to produce machinable welds on cast iron. The soft weld metal is said to bond perfectly with all grades of cast iron. After machining or grinding, the weld metal deposit closely matches the color of the cast-iron parent metal. The core wire has a nickel content of over 99%, and the coating is free of fluorides and other ingredients which generate injurious gases.

The "Ni-Cast" electrode is said to give a quiet, stable arc free from spatter and a minimum of penetration and heating of the cast iron. The weld metal will be free from cracks or cross checks when multiple passes are used. On castings subject to hydrostatic pressures, leakproof welds may be produced without using any special welding techniques or processes, claims manufacturer. The deposit and the fusion zone of the cast iron may be easily machined.

This electrode can be used with alternating current or with either polarity direct current. Best results are obtained with d-c straight polarity, for the arc is then less penetrating and there is a minimum of dilution of the base and parent metal. Available in $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{3}{16}$ in. diameters. PAGE STEEL & WIRE DIVISION, AMERICAN CHAIN & CABLE Co., Inc., Monessen, Pa.



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Users of Arcos electrodes are welding stainless and alloy metals with *assurance* because of Arcos ability in research, in manufacturing, in establishing proper techniques, and in direct field service to Arcos users.

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for Arc Welding
ALL Stainless Steels and Alloys
including
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STAINLESS AND ALLOY WELDING ELECTRODES
and OXYARC PROCESS FOR CUTTING METALS

60 DAYS SAVED WITH BRIDGEPORT No. 192 LOW FUMING BRONZE

To replace the beam of this 30,000 pound capacity scale would have required over two months. Fortunately, however, both time and the cost of a new part were saved by repairing the beam by brazing with Bridgeport's No. 192 Low Fuming Bronze.

In maintenance and repair work of many worn or broken parts—large or small—Bridgeport Bronze Welding Rods have proved themselves real time-savers. In many cases the need of dismantling equipment to make repairs is unnecessary because expensive preheating and slow cooling are not required.

For quick, strong, dense welds—often stronger than the parent metal itself—investigate the many advantages of Bridgeport's free-flowing bronze welding rod. Applicable to steel or cast iron, brazing can be used for repair, maintenance, building up worn surfaces or fabrication.

Send today for booklet, "Bronze Welding Alloys."

"Bridgeport" BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • Established 1865

WELDING ALLOYS AVAILABLE

BRIDGEPORT No. 192 BRONZE—LOW FUMING
General purpose alloy. Ideal for repairing heavy-duty equipment as well as small parts—building up wearing surfaces—joining parts in industrial and construction work.

BRIDGEPORT BRONZE
Fuses readily at 1625° F. Recommended for uniting cast iron and steel parts—building up wearing surfaces—joining parts in industrial and construction work.

NAVAL BRASS
Not as high in tensile strength as Bridgeport Bronze. Suitable for repairing steel and cast iron—joining piping—building up wearing surfaces.

BRIDGEPORT MANGANESE BRONZE (NAVY)
Recommended for strength and toughness in repairing cast iron and steel castings—building up worn surfaces—joining parts in industrial and construction work.

BRIDGEPORT No. 1232 SILICON BRONZE
Used for oxyacetylene, carbon arc or metallic arc welding methods for making silicon bronze storage tanks, automatic heaters, corrosion resisting ducts, structural sections, vats, etc.

BRAZING ROD
Satisfactory for conditions that are not subject to great wear or heavy shock loads.

Bronze Welding Rod A PRODUCT OF
BRIDGEPORT BRASS

Series "A" timer contactor for spot welding and other delicate operations

Electronic Timers

A SERIES of electronic timers and contactors for spot welding are being offered in two different models. Series "A" is suited for short-time operations of 45 cycles or less on loads up to 1 kva. Its accuracy gives excellent timing in the ½-cycle range, and it is applicable to many delicate welding operations, including the joining of fine filaments for electric lamps and electronic tubes.

Series "B" timer contactor has a time control ranging from ½ to 45 cycles and an electronic contactor capable of handling loads up to 15 kva. A 20-step current control allows from 20 to 100% of the full welding heat, insuring accurate control of welding temperature. The xenon-filled power tubes are said to assure quick start and good operation under all conditions of temperatures. ELECTRONIC PRODUCTS CO., P.O. Box 74, North Aurora, Ill.

* *

Aluminum Solder

RECOMMENDED for filling and soldering where tightness is essential but strength unimportant and for the repai of blowholes, building up worn surfaces on aluminum castings, etc., is a new "rub-on solder" which may be applied without flux at low temperatures. This aluminum soldering rod is useful for the assembly of aluminum shapes and wire in production work. It may also be used to repair cracks in aluminum cylinder heads and to filling in surface defects where high temperatures must be avoided. ALL-STATE WELDING ALLOYS CO., INC., 96 W. Post Road, White Plains, N.Y.

* *

Electroplating Generators

A LINE of low-voltage electro-plating generators is announced for plating with nickel, chromium, copper, brass, cadmium and other metals. The standard tank size normally employed contains about 250 gallons of solution. There are six models, ranging in capacity from 100 to 2,000 amp at 6 volts. For chromium plating, individual 1,000-amp, 60-volt generators may be used right at the tank. MOTOR GENERATOR CORP., DIVISION of the HOBART BROTHERS CO., Hobart Square, Troy, O.

EASY-FLO

—LOPS TIME AND COSTS IN PRODUCING THE "LIMB-LOPPER"

VALVE ASSEMBLY — 1010 steel with bronze fittings—13 joints—brazing time 105 seconds. EASY-FLO rings are preplaced at all joints.

The Limb-Lopper is an air-operated pruning shear recently put on the market by the Miller-Robinson Co. of Los Angeles. In its assembly are *36 joints*, all mass-production brazed with EASY-FLO — all with one-piece strength—all air-tight.

This modern streamlined pruner is typical of the hundreds of new metal products of every description now made with EASY-FLO—with surprising savings in production time and costs.

***BULLETIN 12-A* gives you the full facts and reasons for the high-strength, speed, reliability and economy of EASY-FLO brazing. It also tells you how to put EASY-FLO to work on your own metal joining. Write for a copy today.**

HANDLE ASSEMBLY in induction coil with ring of EASY-FLO wire preplaced and Handy Fluxed ready for heating. Note clean joints in finished assembly.

AT THE WESTERN METAL EXPOSITION
OAKLAND, CALIF., MARCH 22-27

See our working exhibit of low-temperature silver alloy brazing — with many examples of actual jobs. See particularly the new EASY-FLO 45 in action.

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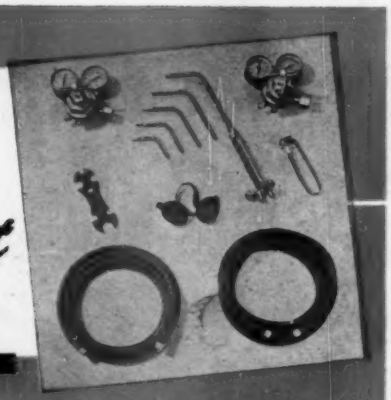

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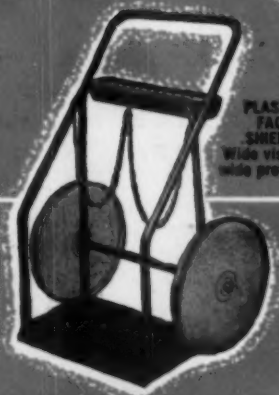

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Take advantage of big savings in time and money by standardizing on BURDOX products for all your welding and cutting needs. Designed by welding men for welding men, every BURDOX product offers you the latest improvements and superior quality at prices that mean savings to you. At all leading welding supply distributors.

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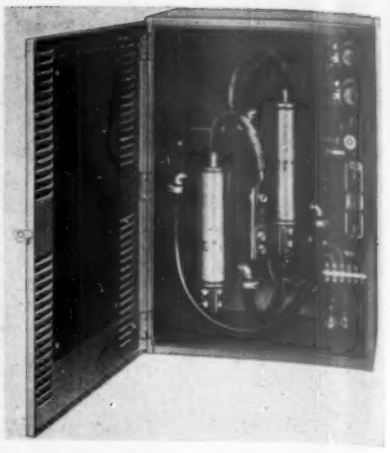


Electronic contactor for resistance welding

Electronic Contactor

A LINE of electronic contactors using ignitron tubes is offered to supplement the Square D, "Syncro-Break" and "High Speed" magnetic contactors for resistance-welding jobs involving high-speed operation or heavy primary currents of short duration. The design provides increased wiring space and power connections made near the center of the enclosure to minimize bending of the power cables. Contactor is assembled on a removable steel base plate, and all control elements are grouped at the righthand side away from tubes and cables. It is housed in a heavy sheet-steel cabinet provided with ventilating openings in the door and drain holes in the bottom. SQUARE D CO., INDUSTRIAL CONTROLLER DIVISION, 4041 N. Richards St., Milwaukee 12.

* *

Fire Extinguisher

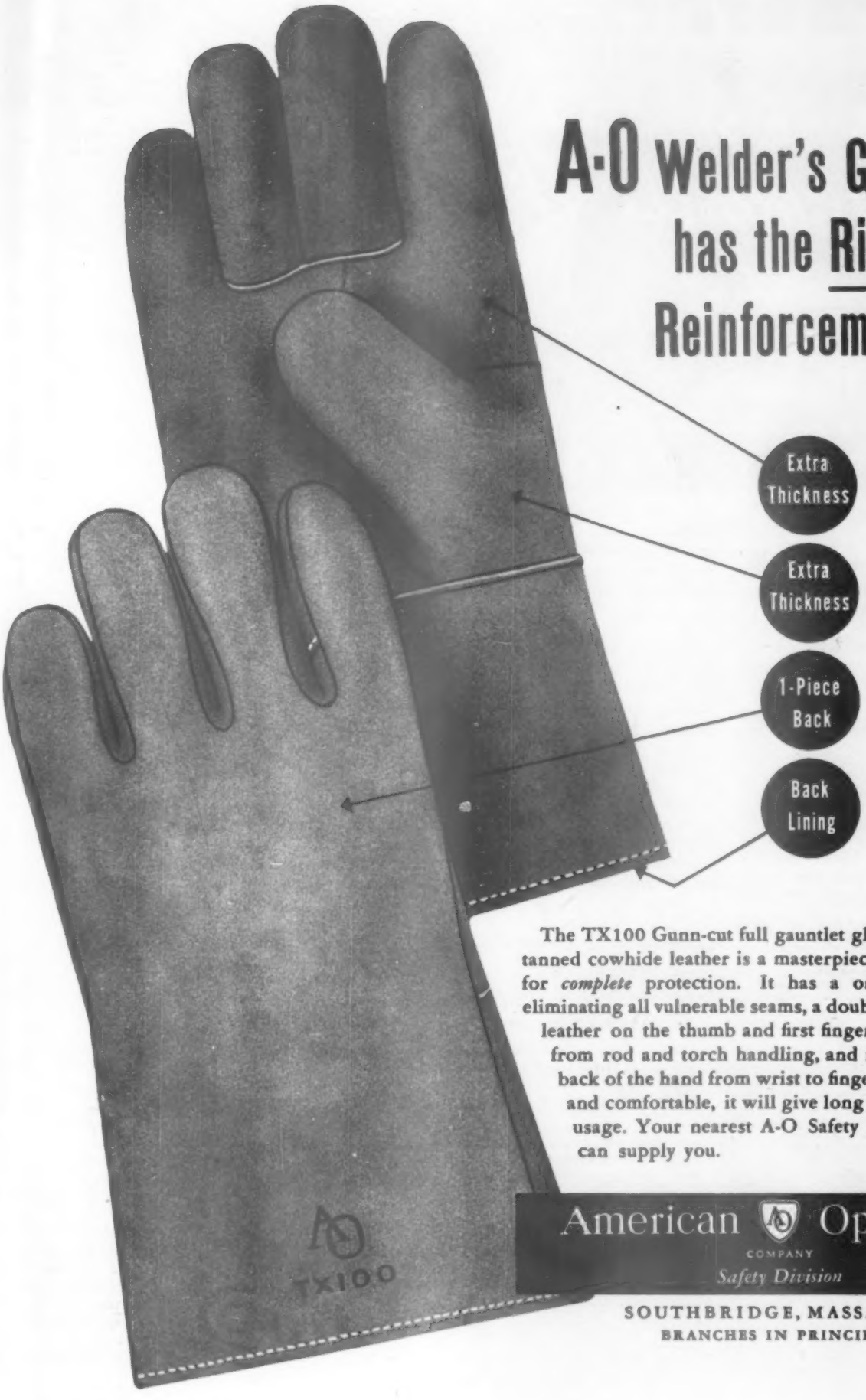
"STOP-FIRE," a stored-pressure hand extinguisher, is said to be as easy to operate as a garden hose. All the user has to do is point the hose at the fire and give the valve a quick flick with the fingers to release the fluid. Hose attachment enables a fire to be attacked in any direction, and the bulk of the stream travels from 15 to 25 ft. The smothering fluid consists of carbon dioxide combined with carbon tetrachloride. A pressure gauge is attached to the extinguisher to indicate fluid pressure at all times. UNION STOP FIRE CORP., Brooklyn.

* *

Crane Control

A MAGNETIC control for floor operated cranes is offered for use on cranes ranging in size from simple hoists to three-motion bridges. Protective features include an emergency stop button which instantly cuts-off the power from all crane motors. The "pendant pull" station weighs only 8½ lb and may be suspended from the trolley of the crane or mounted on rigid support for stationary hoists. CONTROL DIVISION, GENERAL ELECTRIC CO., Schenectady 5, N. Y.

A-O Welder's Glove has the Right Reinforcements



The TX100 Gunn-cut full gauntlet glove of chrome tanned cowhide leather is a masterpiece of designing for *complete* protection. It has a one-piece back, eliminating all vulnerable seams, a double thickness of leather on the thumb and first finger to resist wear from rod and torch handling, and is lined on the back of the hand from wrist to finger tips. Flexible and comfortable, it will give long service in hard usage. Your nearest A-O Safety Representative can supply you.

American Optical
COMPANY
Safety Division

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES

THE PIONEERS of tool and die WELDING ELECTRODES

. . . can help you save 4 ways

Typical repair to forging die with Eureka "Drawalloy" Electrodes.

The use of Eureka Tool and Die Welding Electrodes can help you save man-hours, conserve valuable tools and dies and minimize production delays in 4 ways: 1. Repairing dies. 2. Composite fabrication. 3. Correcting design. 4. Rectifying errors.

Save tons of forging dies and untold man-hours by eliminating resinking operations! Eureka "Drawalloy" Welding Electrodes do the trick by rebuilding to original dimensions the contours of forging dies that have heat-checked or spalled!

Oil hardening Tool-Steel punch Eureka Welded with Oil-hardening Electrodes.

You can efficiently repair worn or discarded Tool-Steel Dies with Eureka's complete line of Tool-Steel Electrodes. Welded deposits will match the characteristics of Tool-Steels in their various classifications. The deposits are "hard-as-welded". Subsequent heat treatment unnecessary if the units lend themselves to grinding. Send for full descriptive literature.

Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

225 Leib Street • Detroit 7, Michigan

NEW EUREKA HIGH SPEED STEEL WELDING RODS BULLETIN

Eureka No. 2 High Speed Steel Welding Rods repair high speed steel cutting tools, compositely fabricate, create cutting, wearing or bearing surfaces. Procedures given.

Welding Equipment & Supply Co.
223 Leib Street,
Detroit 7, Michigan

Rush me Bulletin explaining use of No. 2 High Speed Welding Rods.

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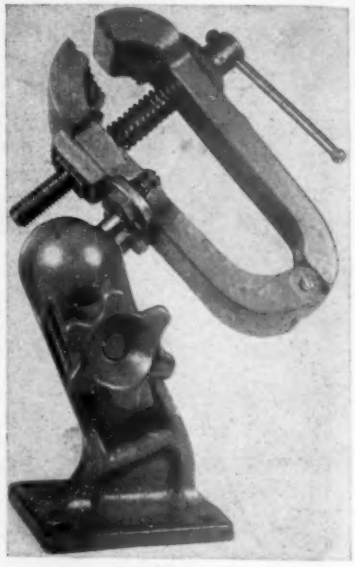
Weldor's goggle gives protection against chemical and dust hazards

Welding Goggle

THIS new rubber-frame goggle is equipped with a single large acetate lens to protect workers against chemical and dust hazards without sacrifice of wide-angle vision. Goggle has good ventilation and may be worn over most types of prescription glasses. Perforations at the top and sides reduce the possibility of fogging. AMERICAN OPTICAL CO., Southbridge, Mass.

* *



Universal holding fixture for small jobs requiring welding, farm or home repairs

Holding Fixture

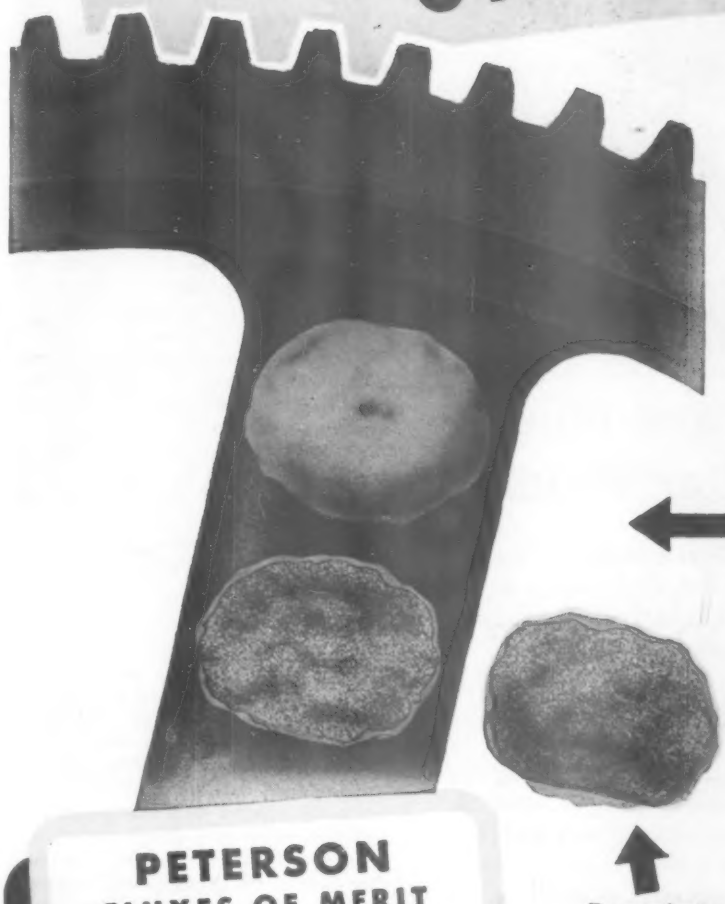
DESIGNED for the weldor, farmer, repairman or home craftsman is a new positioning holding fixture for small jobs. The arm holding the workpiece operates smoothly on a ball-and-socket joint that allows the work to be readily moved to any desired angle. A mechanical clamping control prevents creeping. The workpiece is bolted or clamped to an adaptor plate. CUMMING TOOLS, INC., 501 E. 18th St., Kansas City 8, Mo.

* *

Hose Masks

A NEW hose mask, approved by the Bureau of Mines supplies, fresh air from an uncontaminated source without the use of chemicals or compressed oxygen. An "All-Vision" facepiece gives comfort, wide-angle vision and a gastight fit. The harness of this mask is also a safety belt to which a life line may be attached. MINE SAFETY APPLIANCES Co., Braddock, Thomas & Meads Sts., Pittsburgh, Pa.

Stronger BRONZE WELDS ON CAST IRON



"PETERSON" FLUX ASSURES STRONGEST BOND KNOWN TO BRONZE WELDING—WITH FAST CLEANING ACTION

Using PETERSON No. 3 Special Low Heat Flux, these two bronze buttons were welded to this rusty, greasy gear casting without first grinding or chipping.

PETERSON Flux was wiped over a heated red spot the size of a quarter; then the flame was played over the spot until the scale and oxide were washed off to the side. The Flux, with heat applied, floated all scale and oxides, which the flame washed off.

Melted bronze was dropped onto the spot where it flowed and penetrated into the pores of the cast iron like water dropped onto a blotter. Bronze was added until the button was ¾ inch high.

Bronze button was knocked off with a chisel held at 30 degree angle. NOTICE LARGE CHUNK OF CAST IRON PULLED AWAY WITH THE BRONZE BUTTON, PROVING THE BOND.

PETERSON FLUXES OF MERIT

No. 1 BLUE—for brazing steel, malleable, clean cast iron. For welding brass, bronze and copper. 75¢

No. 2—HIGH HEAT—for brazing cast iron at medium and high heat. 1.50

No. 3 SPECIAL LOW HEAT—for brazing cast iron at low and medium heat. 2.00

No. 5 CAST—for welding cast iron without pinholes or hard spots. Leaves a soft machineable weld. 75¢

ORDER BLANK

Fill in blank spaces for quantity of each flux desired.

_____#1 Blue _____#2 High Heat

_____#3 Special Low Heat _____#5 Cast

Name_____

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If your jobber does not stock Peterson Flux at this time, mail order blank to us at the address shown below.

PETERSON WELDING LABORATORIES

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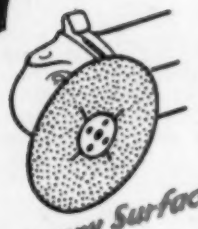
Van Dorn
Portable Electric
SANDER

Power

to Save Time and Muscle
Before and After Welding



Sands any Surface

Grinds any Metal

Speeds Wire Brushing

Van Dorn Portable Electric Sanders are packed with power to speed up a variety of welding jobs. You can quickly prepare the surface to be welded by using Van Dorn Sanders with abrasive discs and "Whirlwind"* Wire Cup Brushes to remove rust, scale, oxidation and old paint. With saucer grinding wheels, they do a fast job of "V-ing out" the joint to be welded. After the weld has been made, use Van Dorn Sanders with saucer grinding wheels for swift removal of excess metal—and with abrasive discs for a satin-smooth finish.

Ask your nearby Van Dorn Distributor for complete information on these versatile tools and for help on any tooling problem. For your free copy of our complete catalog, write to: The Van Dorn Electric Tool Co., 734 Joppa Road, Towson 4, Maryland.

*Trade Mark Reg. U. S. Pat. Off.

FOR POWER SPECIFY

"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

PORTABLE ELECTRIC TOOLS

Surface grinder available in two models for castings of average and large sizes

Surface Grinder

AVAILABLE in two models, the new Peterson surface grinder may be used to obtain flat surfaces on castings, to grind clutch plates and to dress grinding wheels with the addition of a simple jig. A toe-operated control frees both of the worker's hands for the casting during the entire grinding operation. A suction fan is bolted on the underside of the grinder to remove all dust and grit. Grinding wheels are easily changed by removing three bolts. Model 1A is used for average cylinder heads, blocks and similar castings. Model 2A is operated on the same principle and recommended for large, bulky castings. Grinding wheels are 14 and 16 in., respectively, for models 1A and 2A. PETERSON LABORATORIES, Kansas City, Mo.

* *

Plastic Goggles

A NEW line of "EyeGard Champion" goggles is offered in mahogany colored plastic molded to form-fit the contours of the face. In addition to the regular side-screened ports, there are also seven ports around each lens to provide ventilation where it is most needed.

EyeGard champion is made in two styles: No. 31 for grinders and chippers and No. 36 for weldors. The latter model has the ports molded close to prevent the entry of light. Both styles have adjustable nosepieces. AMERICAN INDUSTRIAL SAFETY EQUIPMENT CO., 396 Bridge St., Brooklyn.

* *

Speed Reducer

OPERATING on the inside of a V-belt sheave, is a new wide-range speed reducer having its mechanism entirely enclosed. Various speed reduction ratios up to 600 to 1 can be built into the Hart reduction pulley and applied wherever greater power transmission efficiency from a motor to a driven machine is required. In addition, the pulley may be specified for either single or double clutch brake action. All gears are enclosed and running in oil. HART ENGINEERING & SALES CO., 2015 W. Clybourn St., Milwaukee 3.

Total Area of a Cylinder

By W. F. SCHAPHORST

WHAT is the total outside area of a cylinder? There are many reasons for computing the total area of cylindrical objects—the question frequently comes up in a welding shop, for instance, when it is necessary to estimate the weight of a tank and the weight per square foot of the material composing it is known. Sure it can be figured, but the accompanying nomograph will make it easier.

In order to save time, the writer developed the chart, which instantly gives the total number of square inches, square feet, square yards, etc., in any cylindrical object up to 18 units in diameter, column B, and 10 units in height, column C. The chart automatically adds the two flat ends and the cylindrical surface without any longhand figuring whatsoever.

Let us say, for example, that you want to build a cylindrical tank 6 ft high and 10 ft in diameter. How many square feet of steel plate will be required for that much surface?

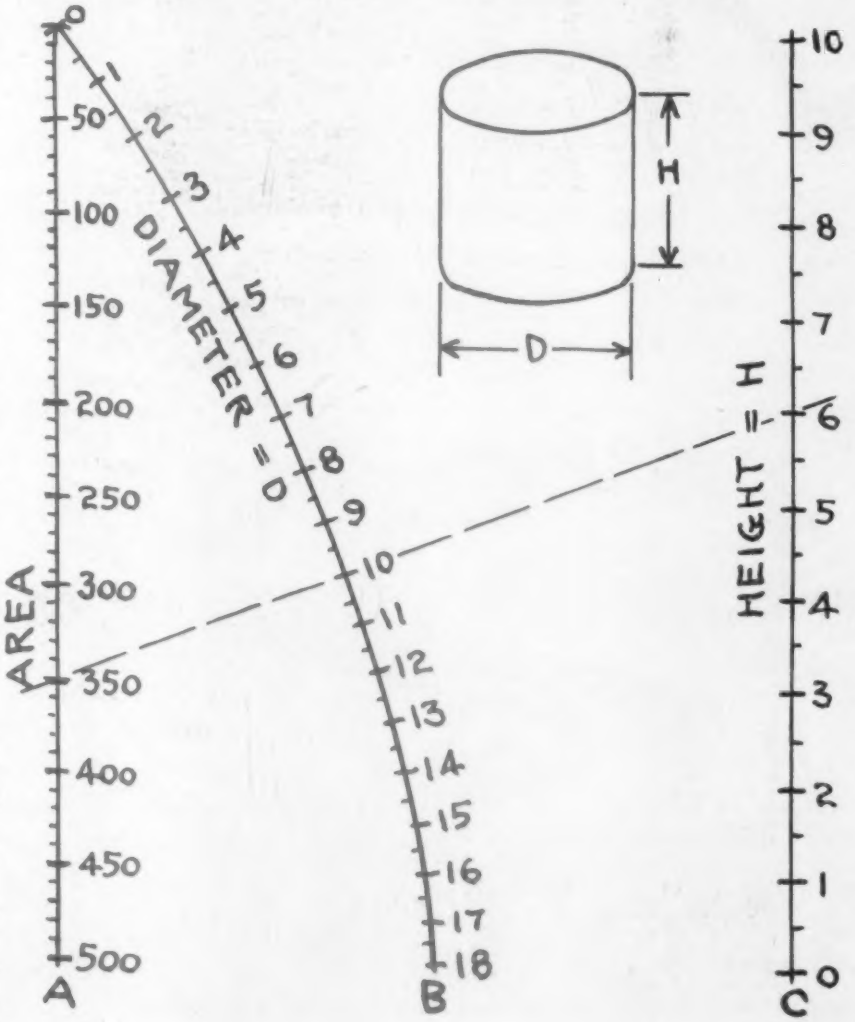
The dotted line drawn across the chart shows how easily the answer is found. The line passes through the 6 in column C and through the 10 in curved column B. The intersection with column A shows that the area is 350. Since the units are feet, 350 sq ft of material will be required. Of course, in flame-cutting the plate it is necessary to allow for scrap.

Any unit of measurement may be used. Thus if the diameter and length are in inches, the area will be in square inches. If the diameter and length are in centimeters, the area will be in square centimeters. And so on. It is obvious, therefore, that the chart will take care of nearly any size.

In the event that the length or height of the object should be greater than given in column C, simply add the nceessary length to that column and then proceed as before. Thus if the height is 20 ft and the diameter 5 ft, double the length of column C. Now, running a line through the 20 in projected column C and the 5 in column B, it will be found that the total area is 350 sq ft. Column C can best be extended by mounting the chart on a piece of white cardboard and continuing the line to whatever scale value is desired.

Here is an interesting point: when the height is zero there will be no curved surface, naturally, but we will have the two flat sides. Thus run a straight line through the 0 in column C and the 15 in column B and you will find that the sum of two flat discs 15 ft in diameter is very close to 350 sq ft.

Check the figures longhand using the formula $\frac{1}{2}\pi d^2$; $\pi = 3.1416$. It will be found that the exact answer to four decimal places is 353.4300. In other words, the chart is surprisingly accurate, being only about one per cent off.



Can you answer these questions about WELDING CAST IRON?

A TWO-MINUTE QUIZ OF INTEREST TO EVERY WELDER

Q. Is it harder to weld cast iron than steel or other metals?

A. Cast iron frequently proves more difficult to weld than other common metals. This is because of cast iron's tendency to change its structure under high heat.

Q. What is the effect of welding heat on cast iron?

A. Some of cast iron's useful properties depend on a proper balance between graphitic and combined carbon. When cast iron is reheated to the molten state, as in welding, some of the graphitic carbon recombines with iron to form combined carbon. Unless the iron cools gradually, the carbides thus formed remain as combined carbon. An excessive amount of combined carbon in cast iron makes the iron hard and extremely difficult to machine.

Q. How can this tendency be eliminated?

A. First, by avoiding excessive heat in the welding zone. Second, by obtaining a slow rate of cooling. Third, by choosing the right welding material.

Q. What is the best method of welding cast iron?

A. All have their advantages. For years, oxy-acetylene was the favorite. Now, however, because of recent improvements in electrode composition, the metal-arc method is coming rapidly to the fore.

Q. What are these improvements in electrode composition?

A. Research on electrodes for welding cast iron has centered around achieving strong, machinable welds, free from cracks and porosity. At INCO this has meant the careful study of the materials used for core wire and flux coatings in the development of the NI-ROD* electrode.

Q. Does NI-ROD provide sound, strong, welds?

A. Extensive use has proved the soundness of NI-ROD welds. NI-ROD's slag does an excellent job of scavenging gas from the weld metal, assuring deposits of maximum strength and freedom from porosity.

Q. Is preheating necessary with NI-ROD?

A. NI-ROD flows so well and "washes" so evenly against the sides of the joint that it is usually unnecessary to preheat the joint. However, hard-and-fast rules cannot be formulated to cover all conditions. Preheating to 300-400°F is useful on many jobs to reduce stresses or provide the highest degree of machinability.

Q. Are NI-ROD welds easily machinable?

A. Yes, NI-ROD's deposit and weld zone are easily machinable. The deposit is nickel, a metal which doesn't lose its machining characteristics under rapid temperature changes. The fusion zone retains its machinability because NI-ROD's smooth arcing and flow characteristics keep the heating-quenching cycle to a minimum.

•

NI-ROD comes in $\frac{3}{32}$", $\frac{1}{8}$", $\frac{5}{32}$" and $\frac{3}{16}$" diameters. Order a 5-lb. package and you'll agree it's the ideal answer to any cast iron welding problem where strong, sound, machinable joints are required.

*Reg. U. S. Pat. Off.

INCO NI-ROD TRADE MARK

Be sure to ask for your copy of the NI-ROD instruction booklet.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK 5, N. Y.

NI-ROD is distributed by:

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WILLIAMS AND COMPANY, INC., Cincinnati, Cleveland, Columbus, Pittsburgh, Toledo
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"How to Clean Welds" teaches weldors thorough methods of weld cleaning which will improve their workmanship and reduce your costs. Many short-cuts that save time and help prevent mistakes are offered in this 16-page illustrated booklet. Send today for as many free copies as you need—use the handy coupon below!

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Clean Welds Mean Sound Welds - Lasting Satisfaction

News of the Industry

RWMA Offers $2,000 in Prizes for Papers

A TOTAL of $2,000 in cash prizes will be awarded this year by the Resistance Welder Manufacturers Association for outstanding papers dealing with resistance-welding subjects. The contest judges will be appointed by the American Welding Society, and the awards will be made at its 1947 fall meeting.

One prize of $750 is offered for the best paper emanating from an industrial source, consulting engineer, private or government laboratory or the like, the subject matter of which is concerned specifically with resistance welding. A prize of $500 will be given for the second best paper in the above classification and a prize of $250 for the third best paper.

A prize of $300 is offered for the paper emanating from a university source—either an instructor, student or research fellow—which in the opinion of the board of awards represents the greatest original contribution to the advancement and use of resistance welding. A prize of $200 will be given for the second best paper from a university source.

The contest is considered as having opened August 1, 1946, and will close on midnight, July 31, 1947. Papers should be sent to the American Welding Society, 33 W. 39th St., New York City 18, N. Y. If mailed to arrive not later than July 1, 1947, three copies should be furnished, otherwise six copies.

* *

Aluminum Now Ranking Second in Volume Produced

As a result of its wartime use and postwar acceptance, aluminum has become the second-ranking metal of peacetime industry in terms of volume produced, according to George R. Gibbons, senior vice-president of the Aluminum Co. of America.

Among the outstanding applications, new and old, which are creating the present demand are: corrugated aluminum sheet for farm and industrial roofing and siding; metal-clad buildings; prefabricated residences and other buildings; heating and ventilation ducts; lightning rods and conductors; and numerous other uses.

In transportation, aluminum construction now predominates in the light plane field. Large quantities of the metal are also being used in the superstructure of passenger and cargo ships, for lifeboats and in the interior partitions of ships. Truck, trailer and bus manufacturers are using more aluminum in body and axle construction.

Letters of the "Wabash" railroad were flame cut and welded to the steel superstructure at 83rd & Kedzie Ave., Chicago

* *

World's Largest Crane Being Built at San Francisco

CAPABLE of lifting battleship gun turrets and other huge sections weighing as much as one million lb, the world's largest overhead traveling crane is now being erected by the American Bridge Co. in the San Francisco naval shipyard at Hunter's Point, Calif. Completion of this giant lift will make the United States fastest on the draw among the nations in the replacement of battleship guns. Swifter repair service for fighting ships will also be made possible by twin cranes that will operate singly or in tandem atop the bridge-type runway. This 730-ft runway is 207 ft high and spans a pier 405 ft wide, extending 162½ ft over the water on each side. The cranes, which have a 142-ft span, will run out over the bay, where they can operate their main hooks through a vertical range of 185 ft—from 25 ft below to 160 ft above water level.

The 8,400 tons of steel which went into the runway structure and cranes were fabricated at plants of the American Bridge Co. in Ambridge, Pa., and Gary, Ind. The structure is designed to resist earthquake shocks and high wind loads.

* *

Linde Builds Plant at Jackson, Miss.

LINDE AIR PRODUCTS CO., unit of Union Carbide and Carbon Corp., has started construction of a new oxygen filling station and acetylene producing plant in Jackson, Miss. These new facilities are located just outside the city limits next to the Illinois Central Railroad. The plant is expected to be in operation this spring.

No More Priorities for Basic Materials

LAST remnants of the wartime priority system which ruled the distribution of basic materials were recently eliminated by the Office of Temporary Controls. Specifically, amendment to Priorities Regulation 28 now limits issuance of the CC rating to three types of cases: (1) items needed to fill military orders which cannot be deferred without hurt to the defense program or to the health and welfare of enlisted personnel; (2) items needed to provide essential utility services or, in emergencies, to eliminate serious hazards to life, health and safety of a large group of people; (3) material and equipment required to maintain or increase production of building materials in short supply.

Veterans anxious to start a new business and small firms which have been receiving governmental priority aid are hardest hit by this measure inasmuch as they are now forced to compete with established companies for materials in short supply.

* *

AISI Technical Session Enlarged

SCOPE of the technical session of the American Iron and Steel Institute, customarily held in connection with the general meetings in May of each year, will be expanded starting this year. The session will be held on May 21, the day before the general meeting, instead of on the same day.

A memorial address, to be designated as the "Charles M. Schwab Memorial Lecture," will be followed by a technical paper of general interest at the morning technical session. Other papers will be presented in the afternoon.

* *

Inco Gives Metal Specimens to Train College Students

INTERNATIONAL NICKEL COMPANY'S development and research division has broadened its coöperation with universities and colleges in the United States and Canada. Under the direction of Dr. W. A. Mudge, assistant director of technical service on mill products, the development and research division is furnishing to each institution an exhibit containing approximately 50 specimens of nickel-containing material and a portable metals identification kit containing about 35 specimens of important metals and alloys for qualitative identification.

* *

Tool Engineers Meeting in Houston, March 19–22

SOME 2,500 tool engineers are expected to attend the 1947 convention of the American Society of Tool Engineers, being held March 19–22 at the Rice Hotel, Houston, Tex. The four-day session includes tours of industries in the Houston area and sightseeing tours of south Texas in addition to the regular technical sessions, committee meetings, general session, etc.

German Flame-Cutting Discussed in OTS Report

OXY-ACETYLENE cutting machines for work on large metal plates, flame-hardening machines and a torch for deep underwater cutting were the notable developments of the German metal welding and cutting industry, according to a recent OTS report prepared by H. R. Pufahl of The Linde Air Products Co. American industry, this investigator declared, has no cutting machines comparable to the large-size German machines. One of these, the so-called "Portal" machine, will take work on a carriage that runs on a 3.9-meter gauge track. These big German units were used in profiling armor plate for tanks.

German flame-hardening equipment was used to harden wheels, gears and shafts. Large machines were used for hardening armor plate. The Germans also developed underwater cutting equipment fueled with benzine fed under the pressure of nitrogen gas. Oxygen at about 200 psi supports the flame.

Other items described in the report (Equipment for Use with Oxygen and Fuel Gases for Welding and Cutting; PB-40315; photostat, $6; microfilm, $2) are welding, cutting, deseaming and gouging torches, regulators, a sheet metal welder and welding rods and fluxes. Orders should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D.C., accompanied by check or money order payable to the Treasurer of the United States.

* *

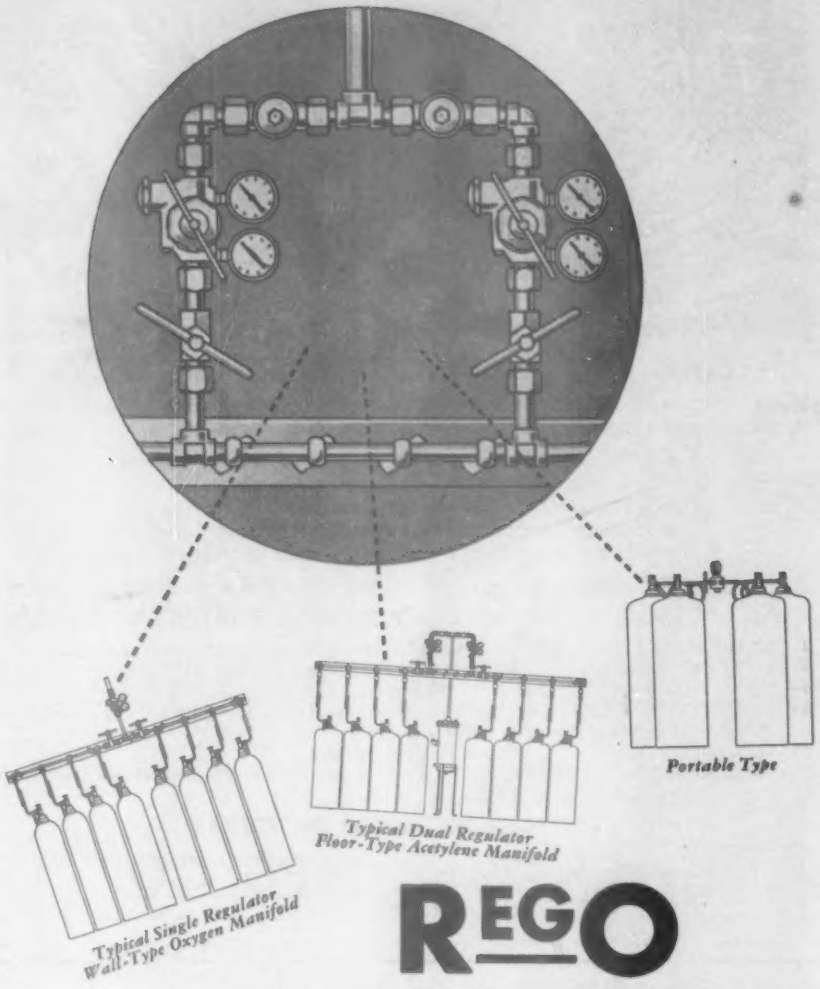
New Firm to Handle Sale of Larkin Lectro Products

NAT J. WEISS, formerly sales manager of Larkin Lectro Products Corp., has formed the Nat J. Weiss Sales Associates, which will handle all domestic and foreign sales of Larkin products. Headquarters of the new organization will be located at the plant of the Larkin Lectro Products Corp., 160 W. 146th St., New York City. The Larkin line includes spot, projection, butt and special resistance welding units and also a-c arc welders featured by "stepless microamp" control. H. R. E. Austin, formerly sales manager of the Rex Welder & Engineering Co., and previously district manager for National Cylinder Gas Co., will be associated with the new Weiss organization.

* *

Arc Welding Builds Heat Transfer Unit

GOODYEAR INDUSTRIES, INC., Chicago, has developed an arc-welded heat transfer unit for the heating of air and gases and the superheating of steam. Temperatures up to 1,000 F can be maintained by the new "Aridizer," which is said to be highly applicable in food processing and for use in rubber, chemical, petroleum and printing industries. The heating of compressed air for drying and dehydrating is made possible by the bilateral fin design.


Typical Single Regulator Wall-Type Oxygen Manifold
Typical Dual Regulator Floor-Type Acetylene Manifold
Portable Type

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CONSTRUCTION

Produces Better Manifolds

● RegO design means safe performance, long life and low maintenance costs. Here are some of the construction features you get when you specify RegO Manifolds...

Unit Construction... The header section of each RegO Manifold is virtually one-piece; extra-heavy seamless brass pipe is run through the forged brass header fittings, the cylinder station shut-off valves and the master shut-off valves . . . all permanent connections are then silver-brazed. The header assembly is bolted to a heavy steel I-beam to assure permanent alignment.

Precision Regulation... large capacity two-stage RegOlators assure constant and uniform delivery pressure to the pipe system.

Extra Convenience... standard RegO Manifold construction provides individual shut-off valves at each cylinder station . . . this design permits any one cylinder to be disconnected without shutting down the entire manifold. Master shut-off valves control each main branch.

Rigid Tests . . . header pipe, valve bodies and fittings withstand pressure up to 10,000 psi and each complete RegO Manifold is subjected to a sustained air pressure test of up to 2,000 psi.

There Is A RegO Manifold to Fit Your Most Exacting Requirements

REGO MANIFOLDS *for* Oxygen • Acetylene • Hydrogen • Nitrogen
and other high pressure gases

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Pioneer and Leader in the Design and Manufacture of Precision Equipment For Using and Controlling High Pressure Gases

CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will increase life of regulator assembly.
- Will eliminate possible injury to operator from burstings.
- Will prevent unnecessary internal wear in regulator (*as NOT necessary to release control screw before opening tank valve*).

PRICE IS LESS THAN ONE REPAIR BILL ($6.00 EA.)

#1. STANDARD COUPLER . . . for all standard size welding type oxygen regulators.
#2. LIGHT COUPLER . . . for "airplane" or soldering size oxygen regulators.
#3. HEAVY DUTY COUPLER . . . recommended for extra heavy duty work only.
#4. SCREW TYPE COUPLER . . . for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.
#5. FOR HYDROGEN . . . left hand thread coupler.

We also Make MEDICAL CHEK-SHOCKS for All Types of Medical Regulators and Tank Fittings (chrome plated) . . . $8.00 Ea.

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WELD-A-CAST FLUX

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OXY-ACETYLENE WELDING FLUXES

Ask your dealer — or write

The Old Brand is Still the best

No. 1. For Welding with Cast Iron Rod.

No. 3. For Brazing and Bronze Welding.

No. 4. For Welding Cast Aluminum.

CORTLAND WELDING COMPOUND CO.
Cortland, N. Y.

Bundy Tubing Available for the Food Industries

DOUBLE-WALL tubing of Monel and nickel is now being produced by the Bundy Tubing Co., Detroit, in standard sizes from 3/16 to 5/8 in. OD and in lengths up to 100 ft. The patented "Bundyweld" process consists of first plating Monel or nickel strip with a bonding metal and then continuously rolling it twice laterally. Edges are beveled in rolling so that there is no appreciable thickening of the joint in the finished tube. The thin plate of bonding metal coating on the strip acts as a fastening agent when the coiled tubing is heated at high temperatures. During the heating, the bonding metal diffuses into the Monel or nickel, leaving the completed tubing with the characteristic finish of the parent metal. Both the bonding and the cooling are carried out in a reducing temperature so that the tube, inside and out, remains clean and free from scale or other products of oxidation.

The completed tubing can be bent, coiled, flanged, flattened, upset, expanded or swaged. Where joints and fittings are required, it can be readily brazed to form strong bonds. Snug joints for sleeves and tubes can also be formed by silver-alloy brazing.

Widely used for aircraft engines during the war, this tubing has demonstrated its suitability for beverage, food, chemical, refrigeration and other industries where corrosion and harmful metallic contamination must be avoided.

* *

Change Closing Date for Davis Award Papers

CLOSING date for papers entered in the A. F. Davis Undergraduate Welding award has been changed from July 1st to April 1st, 1947. This annual contest consists of four cash prizes totalling $700 to be presented to authors and publications for the best articles published in undergraduate magazines or papers during the preceding year. The awards will be presented during the annual meeting of the American Welding Society, to be held the week of October 19, 1947, at Chicago.

* *

Plastics Exposition in Chicago, May 6–10

PLANS for the National Plastic Exposition, to be held May 6 to 10 at the Chicago Coliseum, were outlined recently by William T. Cruse, executive vice-president of the Society of the Plastics Industry, Inc., annual convention of which will be held concurrently with the show. At present writing more than 150 exhibitors have been assigned floor space.

* *

SESA to Meet May 15, 16, 17

THE annual meeting of the Society for Experimental Stress Analysis will be held at the Stevens Hotel, Chicago, May 15–17. The program includes a symposium on shock and impact.

balance your welding books with production

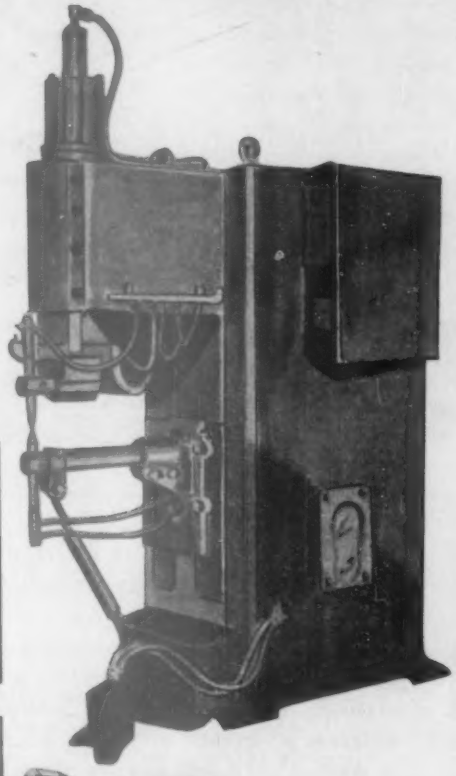
WAA

SURPLUS SPOT AND SEAM WELDERS

USED EQUIPMENT AVAILABLE RIGHT NOW AS LOW AS 40% OF MARKET

Are your labor costs higher? You can balance them off in a hurry by making immediate purchases of WAA surplus welding equipment. Their low first cost reduces the charge-off on each piece required to amortize the equipment . . . and 9 times out of 10 such replacement will give you a modern unit. Prices are low enough to enable you to save money, over and above the cost of reconverting the machine to your specific needs.

Advise any of the Regional Offices listed below of your needs. You may inspect any machine before purchase and buy without delay. You will help yourself and your country. All items are subject to prior sale.



RESISTANCE SPOT WELDERS:

TYPES AVAILABLE: Rocker Arm, Press, Portable or Gun, and some Multi-electrode in well-known makes.

RANGE OF SPECIFICATIONS: Motor, air, hydraulic or manual drive; 10 to 400 KVA; 220-440 volt, 60 cycle, single phase; throat depths 8" to 48"; synchronous and non-synchronous.

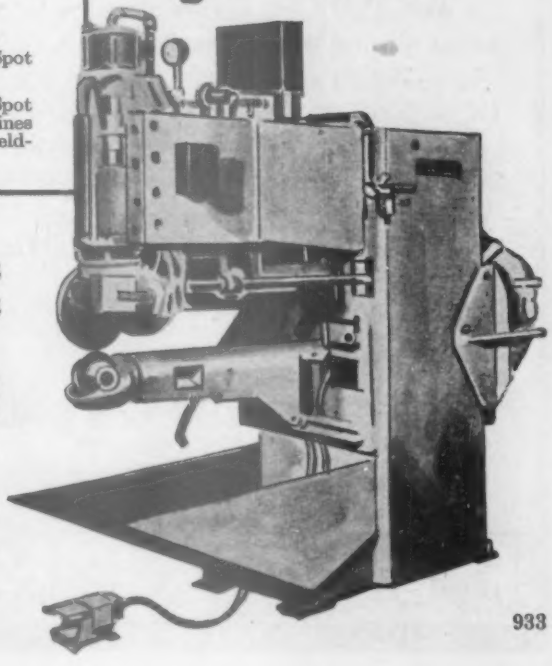
CONDITION: Mostly used, some unused.

RESISTANCE SEAM WELDERS:

TYPES AVAILABLE: Longitudinal, Circular, and Universal.

RANGE OF SPECIFICATIONS AND CONDITION: Same as Spot Welders.

OTHER TYPES: Butt and Flash welders; Stored Energy Spot welders up to 50 KW and 48" throat depth (also a few machines of greater capacity); all types of AC and DC arc welders; welding rod and electrodes; weld positioners.



Principal inventories are located at:

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WAR ASSETS ADMINISTRATION

GOVERNMENT OWNED SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia • Portland, Ore. • Richmond • Salt Lake City • St. Louis • San Antonio • San Francisco • Seattle • Spokane • Tulsa

All welders are sold under existing priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area, and then to purchase the materials offered herein.

EXPORTERS: Your business is solicited. If sales are conducted at various levels you will be considered as a wholesaler. Any inquiries regarding export control should be referred to the Office of International Trade, Department of Commerce, Washington, D. C.

933

Precision Welds

• METALS UP TO 20 GAUGE

A compact spot welding unit. Only 14" high. Designed for precision and production welding. Three station heat selectivity. Water cooled. 6" throat. Foot operated—weight return.

Weldex Inc.

Manufacturers of Precision Welders for Light Gauge Metals

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DEALERS!

Cover the LIGHT METAL FIELD!

Weldex now offers a line providing complete coverage of this important market. If you are a substantial dealer in welding equipment, write for bulletins and our proposition.

Model

- 111-RFM Manually operated (Floor Style) 1 KVA
- 111-PBMT Manually operated (Bench Style) 1 KVA
- 362-PFM Manually operated (Floor Style) 3 KVA
- 263-A Air operated (Bench Style) 3 KVA
- 275-R, 275-P, 275-RS Manually operated (Floor Style) 7½ KVA
- 752-R, 752-P Air operated (Floor Style) 7½ KVA

MANUFACTURERS

Investigate this NEW METHOD of light metal fabrication. Ask for bulletins and folder showing accomplishments with Weldex Welders.

"FLUXINE" Fluxes are the result of over fifty years of scientific research into the metal-joining field. There are 89 FLUXINE Fluxes . . . one for every welding, silver soldering, brazing, and soft soldering operation . . . each with its own properties, designed for a particular metal-joining operation. All have been perfected not only for highest efficiency, speed, and long life, but for economy and safety as well. FLUXINE Fluxes cause no injurious fumes to irritate eyes or nose of the operator.

So confident are we that wherever a metal-joining operation is required FLUXINE Fluxes will do it better, faster, and more economically than any competitive fluxes, that we will be glad to have you try it at our expense.

Write on your company letterhead for a generous sample and directions for using FLUXINE Fluxes on 57 different metals.

Ask your jobber for Fluxine Fluxes . . . he knows the FLUXINE line produces the best results with the greatest economy.

KREMBS & COMPANY

Est. 1875

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FLUXINE

FLUXES TO JOIN ALL METALS

TRADE MARK REGISTERED U. S. PAT. OFF.

ASME Committee Redrafts Unfired Vessel Code

SECTION VIII of the American Society of Mechanical Engineers Boiler Construction Code (unfired pressure vessel code) has been revised by a special committee appointed for this task. The new draft embodies the following additional features: (1) improved and extended rules for the design of formed heads under internal and external pressure; (2) provision for the design of cylindrical shells under external pressure at elevated temperature; (3) joint efficiency for fusion-welded vessels established on a premium basis; (4) spot examination of fusion-welded vessels as a minimum requirement; (5) incorporation of a non-mandatory appendix as a guide for the inspection of vessels in service.

There is no indication at present as to the date of adoption of the proposed revision.

* *

New Members Join NWSA

THREE more welding supply distributors have joined the National Welding Supply Association as active members. These firms are: Anderson Equipment Co., Los Angeles; Arizona Welding Equipment Co., Phoenix, and the Balbach Co., Omaha.

Plans are being made for the NWSA annual spring convention which will be held sometime between April 15 and May 15 in some eastern city. Reservations are now being accepted at the association's offices at 324 E. Second St., Dayton, O.

* *

New Addresses for Three Lincoln Offices

LINCOLN branch offices in San Francisco, Los Angeles and Birmingham have been moved to new locations. The San Francisco office and warehouse is at 1302 Stanford Ave., Emeryville 8, under the direction of L. P. HENDERSON, district manager and welding engineer. Los Angeles office and warehouse is now at 1500 Calzona St., P.O. Box 7336, Station L, L.A. 23. J. B. MCCORMICK is district manager and welding engineer. The Birmingham office is at 113 N. Ninth St., with J. E. DURSTINE as manager and welding engineer.

* *

R-W Firm Opens New Office and Warehouse

K. WM. OSTROM & CO., resistance-welder distributor, has established new office and warehouse facilities at 1525 Wood St., Philadelphia 2. The company was formerly located at 1622 Fairmount Ave. It offers a complete resistance-welding service to manufacturers, including welders, electrodes, forgings, castings, special fixtures, controls and equipment servicing.

Oliver Mining Co. Plans Broad Research Program

OLIVER IRON MINING CO., Duluth, Minn., has made plans for a $34,000,000 research program designed to yield more iron from the Mesabi range. First step will be inaugurated this year by a $2,000,000 expenditure for the construction of beneficiating plants. Four additional plants of varying size and capacity are to be located at various points on the Mesabi range, and additional facilities will be built at the company's research laboratory at Duluth.

The program covers both the use of marginal and high-silica ores and the further reclamation of fine ores now being lost in tailings. Fundamental research work on magnetic and non-magnetic taconites will begin this year as extension of work done by Batelle Memorial Institute in coöperation with Oliver's research laboratory.

* *

Shot Peening Strengthens Stressed Metal Car Parts

BY the modern development of a process used by the ancient sword-makers, Ford Motor Co. is able to increase the life of vital automobile and truck parts by as much as 300%. Shot peening (bombarding metal parts with small shot) is the operation that has added so much strength to highly stressed parts such as ring gears, pinions, connecting rods, leaf springs and coil springs.

The new method is merely a variation of the old practice of cold working metal by hand hammering. Length of exposure and the velocity and size of the shot were among the factors that had to be accurately determined before the process could be employed in regular manufacturing procedure.

* *

Allis-Chalmers Begins New Customer Service

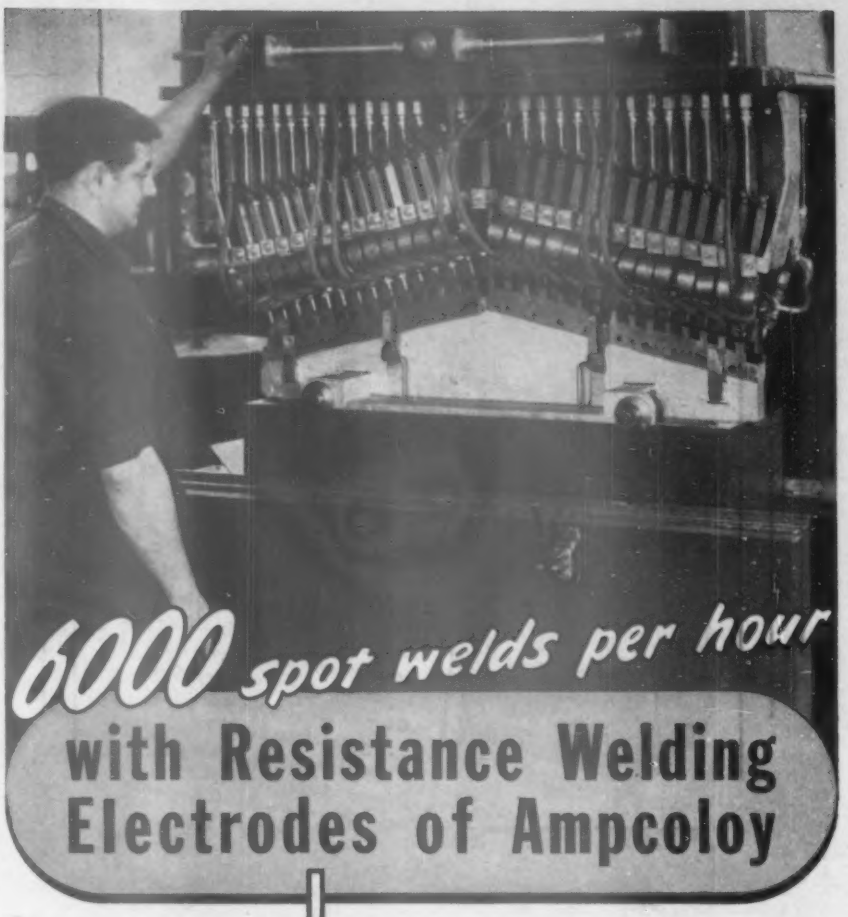
IN order to provide improved customer service, Allis-Chalmers Mfg. Co. has grouped district offices of its general machinery division according to location and similar interests under the direction of regional managers. Each region will have its staff of specialists and will operate as a self-contained field unit.

The first four regional managers are W. F. TAYLOR, New England; D. S. KERR, southeast; J. L. PRATT, southwest and A. J. SCHMITZ, Pacific coast.

* *

Babcock & Wilcox to Expand Research Program in Ohio

IN order to meet postwar opportunities and demands, the Babcock & Wilcox Co., New York, has begun an expanded research program with the purchase of a building in Lexington, O. The one-story structure provides 45,000 sq ft of floor space for research activities. Fields to be covered include metallurgy and welding.



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Resistance Welding Products include...

- spot-welding electrodes
- seam-welding wheels
- centrifugally-cast seam-welder bushings
- seam-welder shafts
- flash- and projection-welder dies
- extruded and drawn rounds
- plus many others

Controlled quality and uniformity eliminate costly production losses

This Hydromatic, spot-welding grille bars to a grille frame at the rate of some 100 assemblies per hour, demonstrates that the controlled quality and uniformity of Ampco spot-welding electrodes result in increased production and lower cost for you.

At Ampco, all resistance-welding products comply with RWMA specifications. Control of quality and uniformity — both absolutely necessary in this exacting field — are kept under close supervision of laboratory technicians throughout the entire production cycle

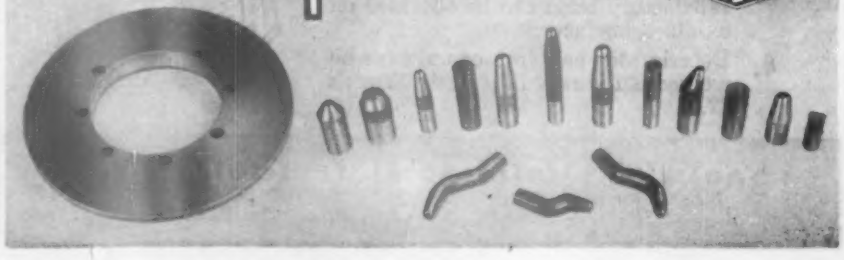
You reduce your welding costs and increase your production when you specify Ampco's *uniform* welding electrodes. Complete details are given in Bulletin 68.

Write for your copy today.

Ampco Metal, Inc., Dept. WE-3
Milwaukee 4, Wisconsin
Field offices located in Principal Cities

RW-4X

AMPCO



Your WELDING JOBS Are Done

FASTER EASIER BETTER

when you use...

Mid-States METAL ZIPPER

Do your welding jobs faster, easier, better and make more money . . . with Mid-States Metal ZIPPER, world's finest arc welder! Packed with exclusive features! Extremely easy to operate! Outperforms anything in the welding field, yet costs no more. Get the most for your welder dollar . . . get a Metal ZIPPER!

See your jobber or write for complete details, now!

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Save Labor!

(WORK ITSELF IS BAD ENOUGH WITHOUT DOING IT THE HARD WAY)

with

YORK'S 77 CAST IRON BRAZING FLUX

1. Fear of overheating can be forgotten.
2. Cleaning and grinding are unnecessary, because "York's 77" penetrates through grease, oxides, etc.
3. Chipping is unnecessary, because a satisfactory bond can be obtained on oxidized surfaces.
4. Deteriorated cast iron can always be welded successfully with "York's 77."

YORK ENGINEERING COMPANY

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G-E Organizes Department for Affiliate Manufacturers

GENERAL ELECTRIC Co. has established an affiliated manufacturing companies department under L. Boulware, general manager, E. J. Harrington, manufacturing manager, and Roy W. Johnson, marketing manager. The manufacturing organizations concerned by the measure are the Carboloy Co., Inc., General Electric X-Ray Corp., Hotpoint, Inc., Locke Insulator Corp., The Monowatt Electric Corp., Telechron, Inc. and the Trumbull Electric Mfg. Co.

* *

New Film Portrays Marquette Production

"MARQUETTE STORY" is the title of a new 16-mm full-color sound movie which presents action shots of details in the construction of Marquette products. The 33-minute film portrays various laboratory steps in the formulating and production of electrodes and shows welders on the job in farms and factories. Copies will be loaned free to interested groups upon request to Marquette Mfg. Co., Inc., Minneapolis 14.

* *

DoAll Co. Opens New Office Facilities

GENERAL sales offices of both the DoAll Co. and the DoAll International Co., recently moved into new quarters at 254 N. Laurel Ave., Des Plaines, Ill.

* *

Ladish Changes Name

LADISH DROP FORGE Co., Cudahy, Wis., producers of steel and alloy forgings, has changed its corporate name to Ladish Co. No changes have been made in the organization or policies of the company.

* *

Hampton Electric Mfg. Co. Operating in New Plant

WITH occupancy of its new four-story plant at 1238 Voskamp St., Pittsburgh 12, the Hampton Electric Mfg. Co., has begun capacity production of its 1947 line of a-c arc welders.

* *

Babcock & Wilcox Moves Los Angeles Quarters

BABCOCK & WILCOX TUBE Co. has moved its Los Angeles office from the Huntley Building to the Petroleum Bldg., 714 W. Olympic Blvd., Los Angeles 15.

New Distributors

The Lincoln Electric Co., Cleveland: Wallner Welding Supply Co., 303 S. First Ave., E. Duluth, Minn.

* *

Air Reduction Sales Co., New York City: Garden State Welding Supply Co., Jersey City, N.J.

Burdett Oxygen to Open West Coast Subsidiary

A WEST COAST subsidiary of the Burdett Oxygen Co., California Air Products Co., will open soon in the Los Angeles industrial district. Built in Huntington Park, Calif., at a cost of $350,000, the plant is designed to furnish gases, welding and cutting equipment and safety equipment for firms in this area.

Capacity of the new California plant will be 2½ million cubic ft of oxygen and a million cubic ft of acetylene per month. Management and personnel will be separate from that of Burdett Oxygen.

* *

Air Filter Buys Badger Corp.

AIR FILTER CORP., 2514 W. Lisbon Ave., Milwaukee 5, manufacturer of "Aircor" filters, has purchased the Badger Corp., Milwaukee, manufacturer of welder filters.

* *

About People

GEORGE N. SIEGER, president, S-M-S Corp., Detroit, has been elected president of the Resistance Welder Manufacturers Association. As chairman of publicity and public relations, Mr. Sieger has been active for the past two years in the expanded publicity and promotional work in which RWMA has engaged.

* *

T. S. LONG, vice-president and general manager, Taylor-Winfield Corp., Warren, O., has been elected vice-president of RWMA. Mr. Long has been extremely active in the work of the association for several years, serving as chairman of the arbitration committee during 1946.

* *

STEPHEN S. CONWAY has been appointed vice-president of the sales department Brake Shoe & Castings division, American Brake Shoe Co. RALPH L. ROBINSON has been appointed assistant vice-president in the same department.

* *

CHARLES S. HEGEL and JOHN W. QUEEN have been appointed managers of the stainless steel and alloy steel divisions, respectively, of Joseph T. Ryerson & Son, Inc. G. VAN DYKE has retired as head of the special steels division after 30 years service with the organization.

* *

DR. KARL T. COMPTON, president, Massachusettes Institute of Technology, has been awarded the Washington Award of the Western Society of Engineers "in recognition of devoted and pre-eminent service of human progress."

Fuse-Well Cast Welding Rods

THE STANDARD OF QUALITY
Throughout the World

CAST ALUMINUM
WELDING RODS
OF STANDARD ANALYSIS

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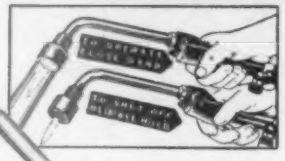

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BLOWPIPE C-46. Has good balance . . . Comfortable grip . . . Closed hand releases gas . . . Open hand cuts it off . . . Reduces idle flame fire hazard . . . Works perfectly with natural gas, manufactured gas, butane and compressed air.

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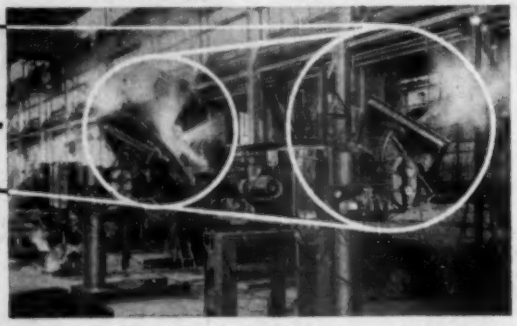
More WELDING going on here.....



More welding and less time spent in flopping, propping up and crawling around weldments is the end result of the C-F Positioners in this welding department.

Mounted on C-F Welding Positioners, weldments can be quickly brought into position for a downhand pass—better, more uniform welds with resulting economies and production increases follow. Weldors spend more time welding when they work with C-F Positioners because one "set-up" on the table allows them to maneuver the job without assistance, whether hand or power operated Positioners are used.

Power operated, variable speed C-F Positioners, with table rotation speeds in any range from 0 RPM and up, coupled with table tilt to 135° from the horizontal make them the logical choice for any production welding operation. Like all C-F Positioners, they have drilled tables for easy set-ups or tables can be quickly removed for installation of special fixtures or jigs. Write for Bulletin WP 22. CULLEN-FRIESTEDT CO., 1309 S. Kilbourn Ave., Chicago 23, Ill.

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds

PRESTON M. HALL has been elected technical executive of the Resistance Welder Manufacturers' Association, 505 Arch St., Philadelphia 6. Mr. Hall served as chief of the Resistance Welding Section, WPB, from 1942–1945 and spent the summer of 1945 in England, Sweden and Germany as a special scientific consultant on welding, to investigate developments in those countries. He expects to spend considerable time in the field, coöperating with technical schools, engineering departments of universities, technical societies and with industrial users.

* *

RAYMOND RUBICAM, New York, has been named to succeed U.S. Senator RALPH E. FLANDERS, Springfield, Vt., as chairman of the Committee for Economic Development research and policy committee. HENRY R. JOHNSTON, New York, has been named executive director, and JOHN H. VAN DEVENTER, New York, director of information.

* *

R. T. STAFFORD has been appointed assistant vice-president of the Allis-Chalmers Mfg. Co., while J. W. McMULLEN has been named general manager of the company's Pittsburgh works. Mr. Stafford will operate out of New York City.

* *

C. W. CULBERTSON has been appointed metallurgical engineer for McNally Pittsburg Foundries, Inc., Pittsburg, Kan. Mr. Culbertson will be in charge of the advisory technical service to casting buyers in the western half of the country.

* *

L. R. MATTHEWS, formerly in charge of the resistance welding division of A. O. Smith Corp., has joined Acro Welder Mfg. Co., Milwaukee, as application engineer.

* *

J. ROBERT FERGUSON, JR., has been appointed assistant chief engineer of the South Chicago plant of Carnegie-Illinois Steel Corp. He succeeds H. L. LIETZ, who has been named chief design engineer.

* *

DONALD M. MOREWOOD has been appointed assistant-vice-president of U.S. Steel Corporation's traffic department. ROBERT C. TYSON succeeds JAMES FLEMING, who retirés as assistant comptroller.

* *

HENRY A. MULLEN, manager of the resistance-welding division of Ampco Metal, Inc., has been elected chairman for 1947 of the alloy group of the Resistance Welder Manufacturers' Association.

* *

RICHARD D. GRUMAN has been promoted to the RegO sales department of the Bastian-Blessing Co., Chicago. Since his discharge from the armed forces, Mr. Gruman has had several months experience in the company's inspection department and several in expediting.

T. C. BALLOU has been appointed manager of welded products sales, American Car Foundry Co., N.Y. Mr. Ballou will be in charge of sales of all weldments and welded products other than tanks, pressure vessels and railroad cars.

* *

DR. LAURENCE C. HICKS has been appointed assistant director of research of the Allegheny Ludlum Steel Corp. JOHN H. CREDE succeeds Dr. Hicks as associate director of research in charge of magnetic steel and allied products.

* *

DONALD A. MACNEIL, formerly vice-president of the Kelley Steel Works, Inc., has joined the sales staff of the forging division of Tube Turns, Inc., Louisville. Mr. MacNeil will make his headquarters at 327 S. LaSalle St., Chicago.

* *

JOHN B. GIRDLER has been appointed assistant general manager of sales of the Vanadium Corp. of America, New York City. Mr. Girdler will also handle Corporation sales in the eastern district.

* *

G. LAWTON JOHNSTON has been appointed assistant general manager of sales for National Tube Co. Mr. Johnston will handle the sale of products manufactured at Christy Park works, McKeesport, Pa.

* *

GERALD E. RHODES has been promoted to the position of assistant manager of the Gary local plant, American Bridge Co. He succeeds JAY K. THOMPSON, who retires after 44 years with the company.

* *

HOWARD HANSEN has been named supervisor of the office of J. L. Singleton, manager of district offices of the Allis-Chalmers Mfg. Co., Milwaukee.

* *

JAMES M. DARBAKER has been promoted manager of Carnegie-Illinois Steel Corporation's Chicago district operations. He succeeds WALTER E. HADLEY, retired.

* *

JOHN P. MCWILLIAMS, Cleveland industrialist, has been elected a member of the board of directors of Union Carbide and Carbon Corp.

* *

J. V. CREMONIN has been appointed manager of a new export sales office opened at 21 State St., New York City, by All-State Welding Alloys Co., Inc.

* *

HARRY E. ORR has been appointed general manager of operations of the Bridgeville, Pa. and Niagara Falls, N.Y., plants of the Vanadium Corp. of America.

* *

H. J. FRENCH has been appointed assistant vice-president of the International Nickel Co. of Canada, Ltd.

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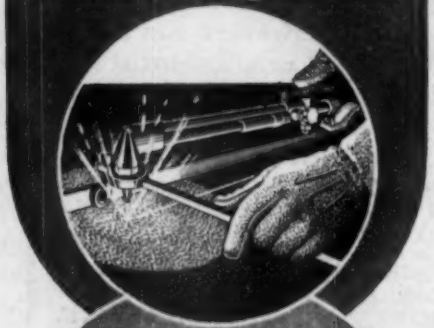

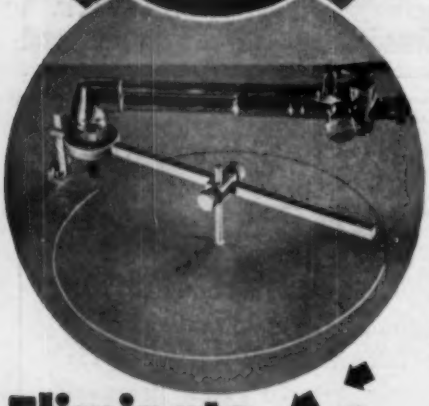

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AIRCO	1
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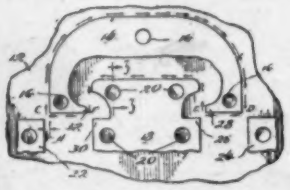


Flame-Cutting Template

2,412,147 STANLEY W. HAYES, Richmond, Ind., assigned to HAYES TRACK APPLIANCE CO., Richmond, Ind. Filed Aug. 26, 1942. Issued Dec. 3, 1946.

A template adapted to be used with a tracing wheel of a flame-cutting machine to effect movement of the torch along a path requiring a change in direction of movement (as from a generally clockwise to a generally counterclockwise direction) and requiring relatively sharp turns to be made. The wheel-guiding structure has configured portions extending upwardly from the base and corresponding to the desired torch movement; these wheel-guiding surfaces are so located that one side of the wheel may be brought against certain surfaces corresponding to a generally clockwise movement and the other side of the wheel may be brought against other surfaces corresponding to a generally counterclockwise movement. The portions are continuous to correspond to continuous portions in the work and discontinuous in regions whereat a change in direction of movement of the wheel is required. Supplementary guiding surfaces are provided to assist an operator in making sharp turns with the tracing wheel; these are parallel to the first-mentioned guiding surfaces but are spaced apart a distance sufficient to provide a land for the wheel and to engage the other side of the wheel as the wheel is brought around the turn.

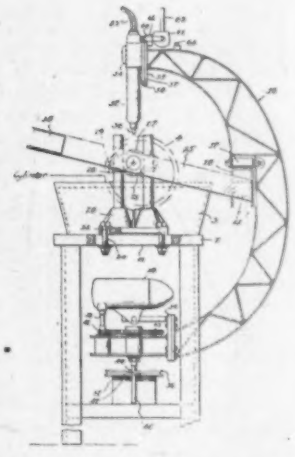
* *

Weld-Time Totalizer

2,412,745 DAVID PACKARD, Palo Alto, and NOEL E. PORTER, Berkeley, Calif., assigned to HEWLETT-PACKARD CO., Palo Alto, Calif. Filed Dec. 17, 1943. Issued Dec. 17, 1946.

A welding circuit type having a relay of low impedance in series with the welding circuit. Connections between contacts of the relay and the control circuits of the starter switch cause the switch to be automatically closed when the relay coil is energized by normal welding current. By connecting certain contacts of the relay with the control circuits of the starter switch, automatic opening of the starter switch is effected after a predetermined time period following interruption of normal welding current. There is also means for supplying an initial operating current to the coil of the relay to operate it upon shorting the welding circuit prior to starting the motor-generator in operation; the latter means includes a transformer having its primary arranged to receive current from the a-c supply lines and its secondary connected to apply current to the welding circuit. Other elements are a relay having a set of contacts in series with the secondary of the transformer whereby the secondary circuit of the transformer is interrupted by deenergizing the coil of such relay, an energizing circuit for the last-named relay, an additional relay having its coil connected to receive direct current from the welding circuit and having a set of contacts adapted to interrupt the energizing circuit of the last relay. The coil of the additional relay is deenergized when the welding circuit is shorted and energized during normal welding operations; supplemental contacts are closed when the coil of the additional relay is energized. The first named relay also has supplemental contacts which are closed when the relay coil is energized by normal welding current. The energizing circuit for the totalizing device is in series with the supplemental contacts so that the totalizing device is energized only during normal arc welding operations and deenergized upon interruption of the welding current or upon short circuiting of the welding circuit.

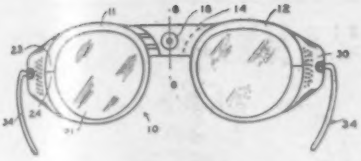
* *



Flame-Cutting Machine

2,413,088 THORNTON L. URQUHART, Detroit, assigned to TAYLOR-WINFIELD CORP., Warren, O. Filed Dec. 13, 1943. Issued Dec. 24, 1946.

An apparatus for flame-cutting, comprising a supporting member carried by a pivotally mounted structure. The axes of the means pivotally mounting the structure and the means pivotally connecting the structure with the supporting member are substantially at right angles to each other. The torch is carried by the supporting member, which also has means for engaging and traversing the template in order to oscillate the supporting member on its axes to cause the cutting flame to traverse and cut the work along a path determined by the template. The angle of cut may also be varied.



Safety Goggles

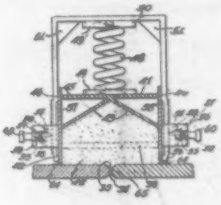
2,412,076 SAMUEL E. BOUCHARD, Brighton, N.Y., assigned to BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Filed June 10, 1944. Issued Dec. 3, 1946.

A goggle eyecup comprising lens-holding means and spaced face-engaging portions extending rearwardly from the lens-holding means at the top and bottom sides. A side shield is pivotally mounted between the spaced portions, and a head-engaging member is attached to the rear end of the shield. The lens-holding means is split at the temporal edge of the lens to provide two free ends, which are detachably securing together so that the lens and side shield are removably held in position.

* *

Portable Flux Box

2,412,065 JOHN EDWARD RUDY and JOHN JOSEPH ZALESKI, Coatesville, Pa. Filed June 4, 1943. Issued Dec. 3, 1946.



A method of arc welding materials using a portable flux box. The steps include: chamfering both sides of the metal to be welded, holding the two parts at the joint firmly in relative position, turning the parts to be welded so that the groove from one chamfer faces upwardly, filling the groove and the faces adjacent the chamfer with flux, pressing the flux into the chamfer, turning the parts to be welded upside down while maintaining the pressure of the flux into the groove, welding the chamfer and then facing upwardly to reverse the parts to face the welded chamfer groove downwardly. Finally, the groove at the chamfer (now facing upwardly) is welded to complete the joint.

* *

Spot-Welding Joint

2,412,175 EDMUND T. RIDGWAY, Oaklyn, N. J., assigned to THE BUDD CO., Philadelphia. Filed Oct. 26, 1943. Issued Dec. 3, 1946.

Method of making a spot-weld connection. An enclosing bead is first formed in at least one of the members to be united while the material surrounded by the bead is simultaneously compressed. The next step is to produce a weld in the central portion of the region surrounded by the bead in such a manner that compressive forces in the material around the weld are substantially neutralized.

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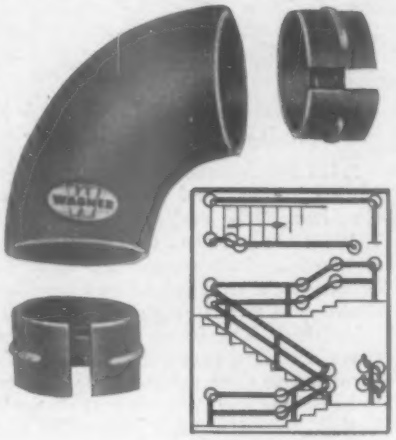

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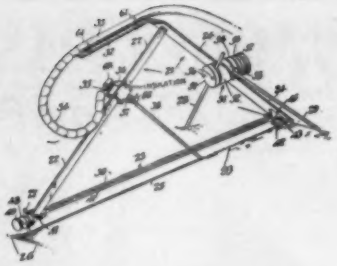


Gravity-Feed Arc Welder

2,412,660 JOSEPH M. TYRNER, New York City, assigned to AIR REDUCTION CO., INC., New York City. Filed July 7, 1944. Issued Dec. 17, 1946.

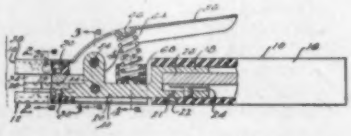
A gravity-feed arc-welding apparatus comprising a triangular frame shape including a slide part, a guiding part and a third side. The frame is supported so that the guiding part will lie substantially parallel with the portion of the workpiece to be welded and the slide part vertically inclined over the guide part. The electrode holder is connected to the slide part to slide down it due to a force of gravity; a rod carried in the holder moves with it past the guide part and into contact with the work. The holder and the rod move down the slide part as material from the contacting end of the rod is deposited on the workpiece.

The guide part comprises a pair of spaced parallel rods, adjustably connected to the lower end of the slide part and the lower end of the third side so as to permit the accommodation of different-size welding rods or to alter the permissible sidewise play for a given welding rod. The adjustable means comprises bolts extending through the rod ends and the slide part or third side part to which the rods are connected, and coil springs on each bolt, to maintain the rod ends equally spaced as the bolts are adjusted to vary the spacing between the rods.

* *

Electrode Holder

2,412,492 EDWARD BRAZITIS, St. Clair Shores, Mich. Filed Jan. 11, 1945. Issued Dec. 10, 1946.



In an electrode holder, a current-conducting member having a cable terminating with a clamping jaw. Insulating material at least partially covers the current conducting member and a metallic channel member at least partially covers the insulation. A bushing of insulating material recessed in the current-conducting member forms a part of a fastening means for securing together the metallic channel, insulating material and current-conducting member. The fastening means is constructed and arranged so as not to form an electrical path from the current conducting member to the metallic channel.

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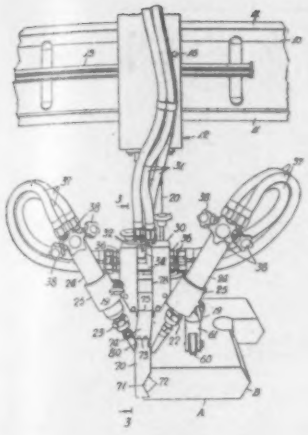
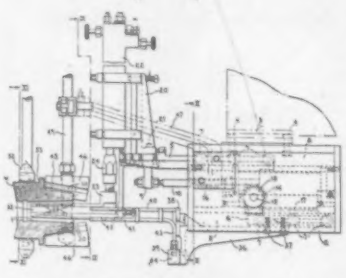


Flame-Beveling Apparatus

2,412,281 CHESTER MOTT, Evanston, and GLENN V. WALLACE, JR., Chicago, Ill., assigned to NATIONAL CYLINDER GAS CO., Chicago. Filed March 26, 1943. Issued Dec. 10, 1946.

The combination of a pilot member in a flame-cutting machine that is adapted to ride over the surface of a workpiece during beveling operations and to support the torch while the pilot member is resting on the surface. The elevational movements of the pilot member, caused by undulations in the surface, are thus transmitted to the torch. A rotatable member permits the elevation of the torch to be adjusted with respect to the pilot member while the latter is resting on the surface. A rotatable means is operable when the pilot member is off the surface for supporting the torch independently at a predetermined elevation.

* *



Flame-Hardening Apparatus

2,412,333 ALBERT L. HARTLEY, Cincinnati, assigned to THE R. K. LEBLOND MACHINE TOOL CO., Cincinnati. Filed Nov. 27, 1942. Issued Dec. 10, 1946.

A longitudinally extending burner projectable into a bore to be flame-hardened and a quenching nozzle that is also longitudinally arranged for presentation into the bore. Movable mounting means are provided for both burner and coolant nozzle, and a common means for reciprocating the respective mounting means so as to alternately insert the burner or the nozzle into the bore. The burner and nozzle are telescopically interrelated so that the nozzle may be inserted into the bore while the burner is being removed therefrom. Longitudinally extending passageways in the burner provide escape for the burned gases and further serve to permit the coolant nozzle to be injected into the bore while the nozzle is being withdrawn

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Contract Awarded

Arkansas—NATURAL GAS LINES—Mississippi River Fuel Corp., 407 N. 8 St., St. Louis, Mo., 6½ mi. 22 in. natural gas lines, in Crossett, to Ford, Bacon & Davis, Crossett, approx. $292,600.

Contract Awarded

★ **California**—GAS PIPELINE—El Paso Natural Gas Co., El Paso, Tex., 100 mi. 26 in. steel gas pipeline, near Blythe, Riverside Co., to Consolidated Steel Corp., 5700 S. Eastern Ave., Los Angeles. $2,500,000.

Contract Awarded

★ **California**—WATER TUNNEL—Pacific Gas & Electric Co., 245 Market St., San Francisco, West Point unlined water transmission tunnel, approx. 2½ mi. long, lined at portals, to T. E. Connolly Inc., 461 Market St., San Francisco; Electra Tunnel, approx. 8½ mi. long, lined at portals only, to Utah Constr. Co., 1 Montgomery St., San Francisco, Morrosin Knudsen Co., 111 Sutter St., San Francisco, and Walsh Constr. Co., 1 E. 43 St., New York, N. Y., both tunnels near Jackson, Amador Co. Est. over $3,000,000.

Low Bidder

Calif., Hillsborough—WATER TANK, etc.—City, City Hall, Jan. 13, two 310,000 gal. and one 635,000 gal. concrete water tanks from Dey Contg. Co., Rt. 1, Box 871 A, Menlo Park, $39,766 and $34,728 respectively; 3 steel tanks, from Western Pipe & Steel Co., 200 Bush St., San Francisco, $40,229.

Low Bidder

★ †**Colorado**—PUMPING PLANT—Bureau Reclamation, Denver, Granby Pumping Plant, from Granby Constructors, Colorado Springs $4,139,998; Granby Pump Canal, from Vinell Co., Alhambra, Calif., $591,459.

Contract Awarded

Colo., Longmont—FLOW LINE, etc.—City, A. R. Slee, engr., 19,830 lin. ft. 30 in. OD welded steel, flow line and penstock, Boulder Co., to Louis Pinello, Route 1, P.O. Box 82, Colorado Springs. $121,000. Awarded 1/15.

Contract Awarded

Ind., Portland—PIPING—Clem Wilson, city clk., Portland, piping for expanding municipal plant, to Dravo Corp., 4810 Prospect St., Cleveland, O. $80,000. Awarded 1/2.

Contract Awarded

★ **Kansas**—CRUDE OIL PIPELINE—Sinclair Refining Co., Box 460, Independence, 50 mi. 18 in. loop crude oil pipeline near Iola, to O. C. Whitaker Co., c/o Dan Waggoner Bldg., Ft. Worth Tex. $2,100,000.

Low Bidder

†**Md., Carderock**—STORAGE TANKS.—Yards & Docks Annex, Navy Dpt., Arlington, Va., Jan. 22, steel water storage tank, Spec. 18075, and rein.-con. water treatment bldg. and portable water supply, Spec. 18079, at David W. Taylor Model Basin, from F. H. Martel Co., 920-17 St. N.W., Wash., D. C., Bid 2 $62,000 and $87,870 respectively.

Contract Awarded

New Mexico—GAS PIPELINE—El Paso Natural Gas Co., El Paso, 14½ mi. 14 in., natural gas gathering pipeline, Hobbs area, force account. $375,000.

Contract Awarded

★ **Oklahoma, Kansas and Missouri**—OIL PIPELINES—Stanolind Pipe Line Co., Stanolind Bldg., Tulsa, Okla., 44.94 mi. 20 in. loop lines for crude oil between Drumright and Blake Station, Okla., to Midwestern Constructors, Drumright, Okla., $1,680,000; 45.88 mi. 20 in. line between Blake Station, Okla., and Centerville, Kan., to Ray L. Smith Constr. Co., Centerville, Kan. $1,740,000; 39.81 mi. 20 in. line between Centerville, Kan., and Freeman, Mo., to Oklahoma Contg. Co., Magnolia Bldg., Dallas Tex., $1,575,000. Grand total $4,995,000.

Contract Awarded

S. D., Philip—WATER SUPPLY—City, water supply sys., to Owen Mann Constr. Co., Deadwood Rd., Rapid City. Approx. $120,000. Bids 1/8.

Contract Awarded

★ **Texas**—PIPELINE—El Paso Natural Gas Co., El Paso, 32 mi. 18 in. natural gas gathering pipelines, El Paso Co., force account. $1,390,000.

Contract Awarded

Texas—PIPELINE—Humble Pipe Line Co., Humble Bldg., Houston, 42 mi. 6 in. crude oil pipeline carrier between Pittsburg and Longview, own forces. Approx. $265,000.

Contract Awarded

Tex., Houston—OIL PIPELINE—Glenn H. McCarthy, Sterling Bldg., addnl. crude oil pipelines. Owner builds. $90,000.

Contract Awarded

★ **Tex., Ingleside**—OIL and PRODUCTS STORAGE, etc.—Sun Pipe Line Co., M. Esperson Bldg., Beaumont, oil and products storage facilities and oil and products docking facilities. Harbor City, 4 mi. south of here, to Lee Aikin, P.O. Box 2350, Corpus Christi, approx. $1,000,000 and approx. $500,000 respectively. W. C. Kinsolving, Beaumont, engr.

Low Bidder

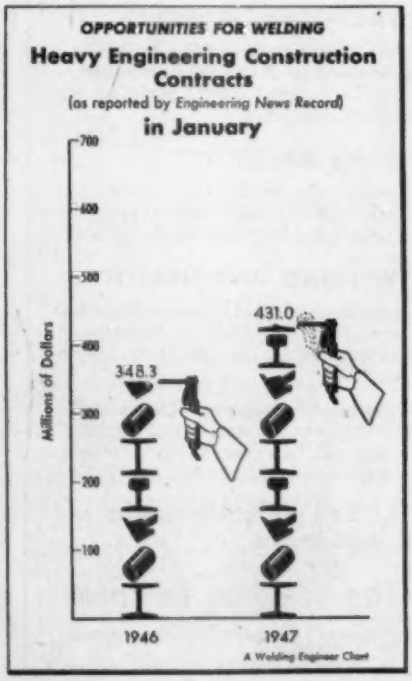
★ †**Washington**—PIPELINES, etc.—Bureau Reclamation, 7½ Second St., Yakima, Jan. 28, manifolds, discharge pipelines and outlet structures for 16 pump. plants of Roza Div. Yakima Proj., Spec. 1588, from Scheumann & Johnson, Lloyd bldg., Seattle, Zone 1. $773,131.

Low Bidder

†**Washington**—PIPELINES, etc.—Bureau, Reclamation, Yakima Jan. 29, earthwork, pipelines and structures lateral distr. sys., Pump Areas 15, 16 and 17 Roza Div., Yakima Proj. Spec. 1623, from J. A. Terteling & Sons, Inc., 4011 Fairview Ave., Boise, Idaho. $224,452.

Low Bidder

Wash., Buckley—WATER SUPPLY—State Dpt. Finance, Olympia, Jan. 10, water supply sys. 20,000 ft. 8- to 12-in. steel and cement asbestos pipe at Western State Custodial School, from Matt Malaspina Co., 1901 23 Ave. S. Seattle. $257,533. Est. $250,000.



AMERICANS ABROAD

Contract Awarded

★ **Saudi-Arabia**—WATER SYSTEM, etc.—Government of Saudi-Arabia, Mecca, design and construction modernization program, incl. electrification of Mecca and Riyadh, water sys. in Mecca, Jidda, and Medina; 330 mi. railroad from Riyadh to Persian Gulf, Pier at Jiddan and hospitals at Jidd and Riyadh, to Bechtel-Morrison-Sverdrup, 155 Sansom St., San Francisco, Calif., U. S. A. Est. $50,000,000.

LATIN AMERICAN

Contract Awarded

★ **Mexico**—GAS PIPELINE—Gas Industrial, S. A. Monterrey (Mexican Gas Co.) c/o F. Elizondo, Monterrey, Mexico, constructing 135 mi. 14 in. natural gas pipeline carrier between Reynosa, Mex., and Monterrey, Mexico (Roma, Tex. area) to Contratistas del Norte, S.A. (an affiliate of O. C. Whitaker & Co., Dan Waggoner Bldg., Fort Worth, Tex. U. S. A.) Monterrey. $1,250,000.

Contract Awarded

★ **Venezuela, Bahi Amuay (Island of Paraguana)**—OIL PIPELINES, etc.—Creole Petroleum Corp., 350 5 Ave., New York, N. Y., U. S. A. oil pipeline to Williams Bros. Corp., Natl. Bank Tulsa Bldg., Tulsa, Okla., U. S. A. ***barge dock, to Horance A. Williams, ***dredging harbor to Gahagan Constr. Corp., 90 Broad St., New York, N. Y., U. S. A.***refinery and equip., to J. G. White Eng. Co., 80 Broad St., New York, N. Y., U. S. A. M. W. Kellogg Co. 225 Broadway, New York, N. Y., U. S. A., and Foster Wheeler Corp., 165 Broadway, New York, N. Y., U. S. A.***tanks, to Chicago Bridge & Iron Co., 332 S. Michigan Ave., Chicago, Ill., U. S. A. Total est. $80,000,000.

Structural Bridges and Other

Contract Awarded

Arkansas—BRIDGES—State Hy. Dpt., Little Rock, bridges Sebastion Co., to E. E. Barber Constr., 722 Wheller St., Smith. $113,517. Bids 1/31.

Contract Awarded

Colorado—BRIDGES—State Hy. Dpt., Denver, bridge and approach 0.17 mi. located between Pueblo and Wetmore on S.H. 96, Pueblo Co., from Henry Shorer, Littleton, $67,470; underpass drainage sys. and bridge with gravel approaches 1.066 mi. located west from Swink on S.H. 6, Colo. Projs. FAGH 247 (5) and SN-FAP 247 (4), Otero Co., from Brown Constr. Co., Pueblo. $210,329.

Contract Awarded

★ **Connecticut**—BRIDGES—State Hy. Comn., Hartford, substructure 12 spans 2,448 ft. toll bridge over Connecticut River, Old Saybrook-Old Lyme, to Merritt Chapman & Scott Corp., 292 Pequot Ave., New London, $1,179,47; superstructure, to American Bridge Co., 71 Broadway, New York, N. Y., $2,015,185. Est. $6,000,000

Contract Awarded

Fla., Miami—UNDERPASSES—Dade Co. c/o Co. Comrs., Courthouse, 3 underpasses north of Bakers Haulover, to Acme Constr. Co., 1200 W. Flagler St. $112,900.

Low Bidder

Indiana—BRIDGE—State Hy. Comn., Indianapolis, Jan. 7, bridge, Spencer Co., from R. P. Olinger, Huntingburg. $47,153. Est. $49,736.

Low Bidder

Iowa—BRIDGES—State Hy. Comn., Ames, Jan. 21, bridges, S-579 (1), Hamilton Co., from S. C. Anderson, 2064 E. Grand St., Des Moines, $41,295***F-770 (3), and F-770 (4), Group 1, Wayne Co., from Christensen Bros., Sioux City, $71,076 and 43,633 respectively***Group 2, F-770 (4), Wayne Co., from Cunningham-Reis Co., 500 Liberty Bldg., Des Moines, $50,662.